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DR. PETER SMITH AND HIS DISPENSATORY.[1]

BY JOHN URI LLOYD, PH.M., PH.D.

Close following the frontiersmen, whose footprints were scarcely rubbed out, and whose rifles had not yet been silenced in the territory embracing the Ohio Valley, came a band of men who cleared away the forest and founded their homes among the stumps. The subject of this sketch may be numbered among these people. He was a typical Puritan, an educated, stern man, of indomitable will, and religious to the utmost degree.

The end of the War of the Revolution had been consummated before the Indian had departed from the Miami lands, where this man lived. John Filson tramped from Lexington to the Ohio River, laid out the village of Losantiville, afterward Cincinnati, and, venturing too far from the fort, left his bones somewhere among the adjacent hills. This happened several years after the subject of this sketch was married.[2] David Schœpf, the talented scientist, that

[1] Read at the December meeting of the Cincinnati Section of the American Chemical Society.

[2] John Filson was a surveyor and school teacher. September 6, 1788, he published, in connection with Mathias Denman and R. Patterson, in the *Kentucky Gazette*, of Lexington, Ky., a call for men to make a road to the mouth of the Licking, where Judge Symmes expected to lay out a town opposite the mouth of the Licking. Filson was made surveyor for the proposed village, and coined for it the name L-os-anti-ville, making the name from ville (town), anti (opposite), os (mouth), and L (Licking). The place went by the name *Losantiville* until January 2, 1790, when Governor St. Clair changed it to *Cincinnati*. John Filson did not live to complete this work. In company with Symmes and

energetic Hessian, who, after the surrender of the British, took his pack on his back and tramped over our land in search of American medicinal plants, had not yet written his *Materia Medica Americana*, which is the first systematic publication concerning the American Materia Medica.[1]

B. S. Barton, of the University of Pennsylvania, who, in 1798, contributed the first study of American drugs, from an educational institution,[2] and Samuel Thomson,[3] the combative champion of lobelia, who fought the medical profession and introduced the Thomsonian method of medication, were contemporaneous with Peter Smith. C. S. R. Rafinesque, that picturesque, gifted, erratic, enthusiastic scholar, who devoted his life to science, in his guileless confidence had not yet been misled and ridiculed by Audubon, the brilliant bird painter. The great ornithologist had not yet played his cruel practical jokes on his confiding guest when Peter Smith trod the Kentucky path that Rafinesque and Daniel Vaughn followed afterwards towards their miserable graves.[4]

But enough of this dissertation concerning the men who, in or near the day of Peter Smith, helped to make American Materia Medica history; their trials and privations cannot more than be touched upon in this paper; the subject is Dr. Smith.

Coming into the Ohio Valley from the South that he hated because of its slavery, preaching the Word of God and practising

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others, he started on an exploring expedition up the Miami River, wandered away from the party and was never heard of again. Probably the Indians were responsible for his death.

This historical note concerning a man who took no part in medicine is apparently out of place. But the author fails to find his record in biographical works where it ought to be in place, and therefore ventures to thrust a word into print concerning the man who made for General Washington the first scientific description of Kentucky, who wrote the first history of Kentucky, who surveyed the site where now stands Cincinnati, and who gave to this city a picturesque, original name, that was rudely brushed out of existence by the unfortunate General St. Clair, Governor of the Northwest Territory.

[1] "Materia Medica Americana," 1787.

[2] "Collections for an Essay towards a Materia Medica of the United States," by Benjamin Smith Barton, M.D., 1798.

[3] See "A Narrative of the Life and Medical Discoveries of Samuel Thomson," 1822.

[4] "The Life and Writings of Rafinesque." Prepared for the Filson Club, Louisville, Ky., and read at its meeting, Monday, April 2, 1894. By Richard Ellsworth Call, M.A., M.Sc., M.D.

medicine, Peter Smith, the representative of a class of men who sought neither fame nor gold, and who feared no privation, made his mark and passed away.

"Peter Smith, the Indian Herb Doctor." That name was familiar during the writer's boyhood in Kentucky. The name lingers yet about Western domestic medicine, and is occasionally seen in orthodox medical print. Rafinesque cited Peter Smith as one of the authorities consulted in the formation of his Materia Medica, but Smith's book was lost to sight. Tradition also told of a book by Peter Smith, but no such book was anywhere to be found. Second-hand booksellers, old men and women throughout the "Miami Country," old physicians' libraries were appealed to in vain. Neither is a copy of this book to be found in the Surgeon-General's library. The name of the man alone remained, the book that he wrote had vanished. Then at last the writer gave up the search in despair.

Last summer, by invitation of Mr. Le Roy Brooks, the day was spent with the Toledo Club at Middle Bass Island, Lake Erie. General J. Warren Keifer, in speaking about old books, chanced to mention Peter Smith's Dispensatory, a copy of which he possessed. The lost book was found, and, in addition, the history of its author was recovered, for Peter Smith was the father of General Keifer's mother. Added interest accrued from the fact that it was learned that the field of Dr. Smith's operations about Cincinnati was near the spot where these lines are penned, the old Duck Creek church, a pioneer monument in the history of the Ohio Baptists, in which he officiated, being within a few moments' walk of the home of the writer.

HISTORY OF PETER SMITH.[1]

Dr. Peter Smith, a former resident of Old Columbia, now a part of Cincinnati, had, in pioneer days, some celebrity as a physician in the "Miami Country." He was a son of Dr. Hezekiah Smith, of the "Jerseys," "*a home old man*, or *Indian doctor*." Peter was born in Wales, February 6, 1753, from whence this branch of the Smith family came. He was also a relative of Hezekiah Smith, D.D., of Haverhill, Mass. Peter Smith was educated at Princeton, and was married in New Jersey to Catherine Stout, December 23, 1776. He seems to have early, under his father, given some attention to medi-

[1] Credit is due General Keifer for the facts that gave this information.—L.

cine, and became familiar with the works of Dr. Rush, Dr. Brown, and other writers of his day on "physic," as well as with the works of Culpepper. He also, during his life, acquired much information from physicians whom he met in New Jersey, Pennsylvania, Virginia, North and South Carolina, Georgia, Kentucky and Ohio. He called himself an "Indian doctor," because, as he said, he relied in his practice much on herbs, roots and other remedies known to the Indians, though he did not confine himself to botanical remedies. He seems to have been an original investigator, availing himself of all opportunities within his reach for acquiring knowledge, especially acquainting himself with domestic and tried Indian remedies, roots, herbs, etc.

Starting from New Jersey about the year 1780, he commenced his wandering, emigrating life with his wife and "some" small children. He lingered for a time in Virginia, then in the Carolinas, and "settled" in Georgia. He sought out people from whom he could gather knowledge "of the theory and practice of medicine," and preached the gospel, possibly in an itinerant way. He was a devout Baptist of the old school. A strong anti-slavery man, even in that early day, he could not be content with his Georgia home, as he put it, "with its many scorpions and slaves." Accordingly, he took his family on horseback; little children, twin babes among them, carried in baskets suitable for the purpose, hung to the horns of the saddle ridden by his wife, and thus, without roads to travel, crossed mountains, rivers and creeks. The wilderness was not free from danger from Indians, but he traversed the woods from Georgia through Tennessee to Kentucky, intending there to abide. But, finding that Kentucky had also become a slave State, the dogmatic old man and his family bid good-by to Kentucky. He left that State with a parting shot to the effect that it was the home of "head-ticks and slavery," and emigrated to Ohio, settling on Duck Creek, near the Columbia Old Baptist Church, now adjacent to Norwood village, and near the limits of Cincinnati, reaching there about 1794.

He became, with his family, a member of the Duck Creek congregation, and frequently preached there and at other frontier places, still pursuing the occupation of farming and the practice of medicine. In 1804 he again took to the wilderness with his entire family, then numbering twelve children, born in the "Jerseys and

on the line of his march through the wilderness, the States and the Territories." He finally settled on a small, poor farm on Donnel's Creek, in the midst of rich ones, where he died December 31, 1816. It seems from his book (p. 14), published while he resided at his last home, that he did not personally cease his wanderings and search for medical knowledge, as he states that he was in Philadelphia, July 4, 1811, where he made observations as to the effect of hot and of cold air upon the human system. It is certain that he not only taught to the end in the pulpit, but ministered as a physician to his neighbors and friends, often going long distances from home for the purpose. He concluded, near the end of his long and varied experiences, that: "Men have contrived to break all God's appointments but this: '*It is appointed for all men once to die.*'"

Peter Smith, preacher, farmer, physician, pioneer, aggressive abolitionist before Wendell Phillips or William Lloyd Garrison were born, is buried in a neglected graveyard near Donnelsville, Clark County, O. No photograph or other likeness remains to revive the features of this picturesque personage.

Such is the life-record of this man, who, so far as the writer can determine, published the first western Work on materia medica.

On the following page is a fac-simile title-page of this unique book.

Next follows the rare and lengthy copyright, not of the United States, but of the "District of Ohio." Succeeding the copyright, which covers an entire page, follows the "Advertisement," in which Dr. Smith states that "he puts the price of one dollar on this book of advice, well knowing that seventy-five cents would be enough;" but he adds that "those who do not choose to allow him twenty-five cents for his advice may desist from the purchase" In the preface that follows, words are used in true Oliver Cromwell style, no equivocating, no evasion. An axe is an axe and a spade is a spade. He placed himself directly in the path of the medical profession, an extract from the preface being illustrative of how he censured himself for following the advice of the learned Dr. Rush:

"While I lived in Georgia, a very great attention was paid by almost everybody there to calomel and jalap, for after Dr. Rush's publications relative to the yellow fever, there was calomel and jalap prescribed for everything, so that the poor old tartar-emetic lay dead in the shops, and I, like other fools, gave it liberally."

After the eight-page preface comes the "Introduction," in which,

speaking of the "Doctrine of Respiration," Dr. Smith records an Indian legend that should not be lost:

"An Indian, it is storied, when asked what he thought was the reason of the ebbing and flowing of the tide, made answer: 'You know there is a great deal of odds between a big creature and a little one; a horse draws his breath a great deal slower than a mouse; the world is a big creature—he draws his breath only twice in the day and night; that makes the tide.'"

THE

INDIAN DOCTOR'S DISPENSATORY,

BEING

FATHER SMITH'S ADVICE

RESPECTING

DISEASES AND THEIR CURE;

CONSISTING OF PRESCRIPTIONS FOR

MANY COMPLAINTS:

AND A DESCRIPTION OF MEDICINES,

SIMPLE AND COMPOUND,

SHOWING THEIR VIRTUES AND HOW TO APPLY THEM

DESIGNED FOR THE BENEFIT OF HIS CHILDREN, HIS FRIENDS AND THE PUBLIC, BUT MORE ESPECIALLY THE CITIZENS OF THE WESTERN PARTS OF THE UNITED STATES OF AMERICA.

BY PETER SMITH,
OF THE MIAMI COUNTRY.

Men seldom have wit enough to prize and take care of their health until they lose it—And Doctors often know not how to get their bread deservedly, until they have no teeth to chew it.

CINCINNATI.
PRINTED BY BROWNE AND LOOKER,
FOR THE AUTHOR.
1813.

But it is not of disease expressions and their cure that we, as pharmacists, are chiefly concerned. We find, in the remedies of this old

"Indian doctor," much to interest the historian in the line of American medicine, much information that has been used over and again, and which stands in our works to-day uncredited to its originator, who charged twenty-five cents more than his book was worth for the information his father and himself had gathered from the Indians and others.

Thus in his Materia Medica department, he speaks of "Home Ipecacuanha," a term lost to us now, but which he appropriately used for Indian physic. The absence of balances for weighing led him to instruct the reader to "take a pugil" of it, which is to be "made into a decoction of half a gill," which is to be given, one-third of it at a time, every ten minutes, "until it does work, either up or down."

It is to be regretted that Dr. Smith neglected the use of botanical names. His plants are all employed under common names, but he describes the appearance and habitat of each specimen so carefully as to enable the experienced reader to identify most of them. Rafinesque, who credits Dr. Smith, objects to his common names, which, however, are very interesting in connection with the text. The pains he takes to credit authorities from whom he obtained information is very refreshing, the relationship of their names to the substances used being familiar to us to-day in connection with many drugs.

A few examples of lost terms and others still in use may be cited:

Brinton's or Culver's Root.
Miami Columbo (American Columbo) Root.
The Nine-bark Root.
The Square-stalk Root.
The Corn Snake Root.
The Horse Balm.
The Mountain Mint.
The Sore Throat or Blueberry Root.
The Devil's Nip.
The Devil's Bit.
The Backache Root, etc.

Following the description and uses of simples comes recipes for diseases, in which the originator of each compound is conscientiously credited. We find a few of these names familiar yet, *e. g.*, green ointment and ointment of red lead. Concerning this latter, he refers

to an interesting revolutionary incident where it had been used with good result on a soldier "who had been wounded at the Germantown battle, 1777, in the Revolutionary War. One of his legs had been broken and shattered while he was one of the forlorn party sent to tear down the fence and palings about Chew's house."

Passing to some of his remedies, we are reminded of the animal drugs of mediæval times; *e.g.*, a dead toad is recommended as an application to a wen, and Smith's remedy for toothache—well it would credit the animal extract men, past or present. But this subject must be touched lightly; for are not many members of the medical profession seemingly gravitating again towards the "moss that grows on a dead man's skull" of European mediæval medicine? Dr. Smith seems to have anticipated the cold water curers (hydropaths), but he recorded his views in language that demonstrates that he stood close to some of the sanative surgeons of to-day. He says:

"COLD WATER APPLICATIONS

"I reckon among the choicest of my discoveries.

"The following I recommend:

"When the accident of a bruise, piercing of a nail, a cut, a broken bone, an eye knocked out and put in again, etc., takes place, immerse the part in cold water as quick as possible, and then dip a large, soft linen cloth into cold water and apply it, and keep out the air. This cloth should be kept close; aid this by dropping cold water upon it for fifteen minutes, and continue it close for twelve hours. The inflammation by this means will be kept back, and the cure by anything else will be almost forestalled; and then a bruise, a strain or broken bone, will scarcely swell at all; and a like application to a burn will have a similar effect. In about fifteen minutes the first pain will be over, and the future ease will be steadfast.

"I have tried the foregoing application of cold water, with full demonstrations, for forty years past."

And it needs but little imagination to credit this stern man with a poetic spirit, for he pathetically laments (p. vi) the fact that through his own fault, the "Leotrill" was lost. So earnest is he concerning this precious "Leotrill," met as he journeyed from Virginia to Georgia, that he states that he sometimes thinks of travelling the weary way over again, hoping yet to obtain this "Leotrill."

And that his observing eye caught yet finer lines, is evidenced by the fact that he pointed out an "insect" theory of disease, and placed himself (pp. xiv, xv) in the ranks of the microbe theorists of

to-day by asserting, in an extended argument, that the "plague, yellow fever and other bilious and contagious complaints" were caused by "invisible insects;" and in accordance with his methods the Doctor takes pains to credit another for the suggestion.

But enough has been said concerning this upright, picturesque character—too much some persons may say. Still, the writer feels that his pen has not taken too much space in placing in print these notes concerning the history of this man whose name has been nearly lost, whose face has left no print, but who wrote the first Materia Medica "Dispensatory" published in the West.

LIQUID BENZOIN FOR BENZOINATING LARD.

By Richard M. Shoemaker.

It is an open secret that the gum benzoin of commerce is largely adulterated, the percentage of impurities ranging, in my experience, in what is called very good commercial gum, from 5 to 20 per cent. Apart, then, from the practicability of the present official method of benzoinating lard, which is open to question, it is plain that benzoinating lard with the benzoin of commerce must give rise to variable products.

To overcome this variability, I have been using, for some time, a prepared liquid for the purpose of benzoinating lard. The formula for its preparation is as follows:

Benzoin	20 grammes.
Ether	40 cubic centimetres.
Castor oil, a sufficient quantity to make	15 grammes.

Macerate the benzoin in the ether for twelve hours; filter with proper precautions to avoid loss of solvent; dissolve the castor oil in the filtrate, and distil off the ether carefully.

The oleaginous product is of deep amber color, and contains the benzoic acid and volatile principles of the gum. The residue left after the ether treatment is destitute of odor or taste. The benzoinated liquid can be made and sold commercially for 75 cents a pound. In case of special demand for the liquid, and the making of large quantities, its cost would doubtless be reduced.

I send for examination a sample of the liquid made from Sumatra benzoin imported from Ascheen, which latter left, after the ether treatment, a residue of 13 per cent., mainly bark. The bark, I presume, is that of Styrax benzoin, Dryander.

I send, also, a sample of Siam gum, which contains only 4 per cent. of impurities, mainly bark. The liquid benzoin made from this gum is lighter in color, and has a more delicate aroma, than that made from the Sumatra variety. But the high cost of the Siam gum militates against its general use. A sample of the Siam benzoinated oil is submitted.

To make benzoinated lard, I use the following formula:

	Grammes.
Liquid benzoin	15
White wax	20
Dehydrated lard	965

Melt the lard and the wax by heating with steam heat to eliminate water; add the liquid benzoin, and stir until cold. During warm weather it will doubtless be advisable to replace a part (5 per cent.) of the lard with white wax, as directed by the U. S. Pharmacopœia in its process for making "Adeps Benzoinatus."

Benzoinated lard thus made can be prepared in a very short time—far less than the time required in making the official product. It is a yellowish white solid, possessing in full the characteristic odor of the volatile proximate principles of benzoin. It can be made and sold for 18 cents a pound, and less for larger quantities.

Fourth and Race Streets, Philadelphia, December, 1897.

A CONTRIBUTION TO THE KNOWLEDGE OF THE GUM FROM THE OIL TREE.

By Charles W. Dirmitt.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 172.

This substance is obtained by tapping the trunk of Prioria copaifera. Grisebach describes the tree in his *Flora of the British West Indies* as a new genus, and named it after Dr. Alexander Prior, who possessed a very large private collection of Jamaica plants, constantly referred to in the *Flora*.

The tree attains the height of 80 feet, and measures about 20 feet in circumference near the base. It is known as the "oil tree" in the Bath district, and has been described by Mr. William Fawcett in the *Bulletin of the Botanical Department, Jamaica*, Vol. IV, page 77.

At the request of Mr. Fawcett, who supplied the material, Prof. Henry Trimble made a preliminary examination of it in regard to its solubilities and general chemical properties, chiefly with a view of determining whether the so-called gum resembled balsam of copaiba sufficiently to permit it being used medicinally, or, if of no value in that respect, whether it could be used by unprincipled exporters and handlers of the last-named substance as an adulterant thereof.

The result of this investigation showed that the gum is entirely too dissimilar to the balsam of copaiba to be used for adulterating it, and that it is probably inert medicinally.

The results of Professor Trimble's work were published in the body of Mr. Fawcett's article in the place cited; but as that publication may be inaccessible to many pharmacists and chemists, it is believed that the report could be advantageously incorporated with the present paper.

The sample, as received from Mr. Fawcett, was a thick adhesive liquid, resembling copaiba in appearance. Upon standing, it separated into two layers. When thoroughly mixed it became turbid, on account of a greenish substance which it held in suspension. On the subsidence of this greenish substance, the upper layer, which constituted by far the greater part of the sample, became clear and of a brownish-yellow color. The material had no pronounced odor, but it imparted a fatty taste at first, which gradually became acid. It did not behave like a gum resin when masticated. In thin layers it was transparent, with a pale straw-yellow color. On exposure to air it dried superficially, with a decrease of adhesiveness.

On carefully igniting a portion of the sample, it yielded 0·075 per cent. of ash, consisting of calcium carbonate and sulphate, with traces of the corresponding magnesium and potassium salts. The combustion was attended with the production of a very sooty flame.

The original material was found to be readily soluble in absolute alcohol, ether, chloroform, carbon disulphide, petroleum ether, amyl acetate, ethyl acetate, methyl acetate, amyl alcohol, benzol, toluol, nitro-benzol, aniline, acetone, phenol, oil turpentine, cottonseed oil (therefore, probably, fixed oils in general), glacial acetic acid and oil of camphor.

Alcohol of the specific gravity 0·820 did not completely dissolve it. The portion left undissolved appeared to be the substance causing the turbidity of the sample. Absolute alcohol and chloroform dissolved this residue. The solution in alcohol of the specific gravity 0·820 had a brownish-green fluorescence. Water, glycerin, 36 per cent. acetic acid, and 85 per cent. phosphoric acid, failed to dissolve the original material.

Aqueous solutions of sodium and potassium hydrates and ammonia water produced white insoluble mixtures. Potassium hydrate in alcohol dissolved it with the exception of a few white flakes. Magnesium oxide and water formed

a solid mass, as did also potassium hydrate when it was fused and the material added to it; the resulting mass showed no tendency to liquefy by further heating, nor would it dissolve in water.

The original material seemed to be separated from this by treating with diluted acid in excess, shaking with ether, separating and evaporating the ethereal layer.

About 60 grammes of the original material were mixed with water in a flask, the latter attached to a condenser, and heat applied; the water distilled over, leaving the material in the flask apparently unchanged. No oily layer separated from the distillate, thereby indicating the absence of volatile oil, and determining at once the important distinction of this substance from copaiba balsam.

The distillate was practically clear and colorless, neutral to litmus paper, and gave no color with ferric chloride. An aromatic odor was exhaled during the distillation, and was, to a less degree, noticeable in the distillate. The water remaining in the flask with the material had the same properties as the distillate, and had dissolved nothing. Heat was then further applied to the flask and its contents until all the water was removed. The temperature was then increased and the material, by a decomposition similar to that known as "cracking" in the distillation of petroleum, distilled until about 90 per cent. had passed into the receiver. The residue then began to coke and emit smoky vapors. The black, tarry residue solidified on cooling. The last portion of the distillate had a reddish color, and a strong fluorescence, similar to that seen in paraffin oils—the odor of this portion was distinctly that of petroleum. The first distillates were yellow and had an aromatic odor; these were mixed and redistilled. The distillation began at about 150° C.; about three-fourths of the mixture passed over between that temperature and 360° C. When this point was reached the residue in the flask had a reddish color, a petroleum-like odor and fluorescence like the previously-described fraction. Both processes were evidently accompanied by destructive distillation.

The specific gravity of the original material was slightly higher than water, although it floated on the latter liquid, owing, no doubt, to occluded air. No nitrogen was found to be present.

The substance is either a resinous body, very poor in oxygen, or else a hydrocarbon, or a mixture of several of them. Its physical properties, no doubt, suggest a resemblance to copaiba balsam, and therefore the specific name of the tree; but in composition and chemical properties it bears no relation to either copaiba balsam or gurjun balsam.

Its behavior under high temperature indicated some relation to fixed oils. (See Sadtler on the "Destructive Distillation of Linseed Oil," AMERICAN JOURNAL OF PHARMACY, 1896, p. 485.) It is probably medicinally inert.

In considering the peculiar behavior of the gum when heated, it is of interest to learn, through Mr. Fawcett, that the trees when tapped at certain seasons of the year yield a copious supply of the gum, and that this liquid was formerly used by the negroes for burning in lamps; when so burned it is said to emit a very disagreeable odor.

Professor Trimble kindly supplied the author with the remainder of sample of gum upon which he worked, for the purpose of making a fractional distillation, with a view of determining the composition of the several fractions which had been noticed in the previous distillation.

Before beginning a fractional distillation, the gum was filtered through absorbent cotton in a hot filtration funnel. The filtration proceeded slowly, and it was noticed that the filtrate was much clearer than the original sample, which phenomenon was probably due to the loss of the small quantity of adhering water through vaporization; at the same time the suspended greenish substance was removed by the filtering medium.

This greenish substance was likely sap which had oozed out from the tree with the gum.

The clear filtered liquid was found to have a specific gravity of 1·008 at 15° C.

Metallic potassium immersed in the gum remained bright for some days, then gradually oxidized and disappeared in the gum without altering the transparency, color or consistency of the liquid to any appreciable extent. The product of this solution behaved with water in the same way as Professor Trimble found aqueous solutions of sodium and potassium hydrates to act on the original material.

In order to make a fractional distillation of the gum, 125 grammes of the original material were placed in a flask attached to a vacuum condenser and heat applied. The vacuum gauge showed a pressure of 254 millimetres. As the temperature of the gum was increased, the peculiar cracking sound, recorded by the previous investigator, was observed, and a few drops of condensed steam collected in the receiver as the heat was gradually increased.

When the liquid had reached the temperature of 240° C., it began to boil, but nothing distilled except the small amount of water.

During this distillation of the water the apparatus was filled with a heavy white vapor, which passed into the aspirating tubes, and condensed therein to oily drops resembling the distillate subsequently gotten from the gum.

A thermometer suspended in the gum showed a temperature of 360° C. At this point a small quantity of distillate had passed over into the condenser, but the temperature of this distillate was but

200° C., clearly showing that decomposition was taking place in the hot substance in the flask.

The heat was continued and the thermometer was allowed to remain in the distilling flask until the temperature of the distillate rose to 360° C. Up to this point only a small amount of the liquid had distilled over, although the atmospheric pressure in the distilling flask was the same as at the beginning of the operation.

After the thermometer had been removed, the pressure within the apparatus was again reduced to one-third, and the distillation continued, this time without any attempt to register the temperatures of the distillates when the partial vacuum was destroyed in order to change the receivers, and another receiver had been attached to the condenser and heat reapplied, it was plain to see that the temporary cooling of the gum had the effect of causing its decomposition into lower boiling substances.

Three other distillates were collected. These varied in color, and apparently in specific gravity, as, when a few drops of one distillate fell into the portion preceding it, the two liquids could be seen upon stirring. The first of these liquids had a pale yellow color; the second a yellow color, the third was more yellow than the second, and the fourth was of a greenish color.

Besides the water, which distilled over when the gum was heated, each of the four fractions which were obtained was mixed with water, and it was noticed that the amount of this seemed to bear a definite relation to the volume of the fraction. All the distillates had odors suggestive of acrolein.

In order to obtain these distillates it was necessary to push the temperature to a point where the residue in the flask was a thick, tarry substance, possessing a petroleum residuum odor. Upon allowing this residue to cool it became solid. This residue constituted 1·89 per cent. of the weight of gum taken.

The first fraction obtained in the above distillation was redistilled under a pressure of 250 millimetres. The distillate obtained from it passed over between 100° C. and 310° C., the temperature rising gradually during the process.

The second, third and fourth fractions were also refractioned, but it was impossible to register the boiling points of the distillates obtained from them, although they were distilled under as little as 200 millimetres to 250 millimetres pressure.

The liquids boiled at

	Temperatures. Initial.	Final.
Distillate I	100° C.	310° C.
" II	150° C.	above 360° C.
" III	150° C.	" "
" IV	180° C.	" "

It was obvious, from the irregular boiling points observed for the fractions, that destructive distillation had taken place during these fractionings of the gum, and, in order to inquire into this matter further, it was decided to take the specific gravity of the several fractions, again refraction them, and take the specific gravity of the distillates thus obtained.

The following table shows the specific gravities of the fractions before their last distillation and after the same, also such temperatures of the distillates as could be registered during the distillation:

	Specific Gravities. Before Distillation.	After Distillation.	Temperatures. Initial.	Final.
Distillate I	·920	·910	90° C.	260° C.
" II	·942	·913	150° C.	360° C. and higher.
" III	·976	·929	150° C.	360° C. " "
" IV	·946	·931	190° C.	360° C. " "

These were again refractioned under reduced pressure, and their specific gravities and temperatures were again taken when the following variations were found:

	Specific Gravities. Before Distillation.	After Distillation.	Temperatures. Initial.	Final.
Distillate I	·910	·910	75° C.	240° C.
" II	·913	·910	115° C.	265° C.
" III	·929	·923	100° C.	290° C.
" IV	·931	·915	155° C.	300° C.

Another portion of 125 grammes of the gum was fractionally distilled under ordinary atmospheric pressure, and the four fractions were collected as before. The deportment of the gum under the influence of heat in this case, and the character of the distillates, were very similar to those obtained in the first distillation carried out under reduced pressure.

The distillates were all much thinner in consistency than the original gum; they were also liquid at ordinary temperatures, and possessed considerable odor, while the original material was thick and semi-solid at ordinary temperatures, and almost odorless.

The distillates became more viscous toward the latter part of the distillation; but when they were redistilled several times they lost this property to a considerable degree, as well as the fluorescence which was present in all cases.

The cracking noise which accompanied the heating of the gum, and mentioned by the previous investigator, was observed by the writer both in distilling it under reduced and the ordinary pressure.

The gum did not begin to boil until the temperature of 360° C. was reached, then it began to yield a distillate having a temperature of 215° C., but only 15 c.c. of distillate had collected by the time the temperature of the distilling liquid had attained the temperature of 360° C. The temperature at which the vapor passed over under reduced pressure was 15° less than under ordinary pressure.

The following specific gravities and boiling points of the fractions were found:

	Specific Gravities.	Temperatures., Initial.	Final.
Distillate I	·949	115° C.	above 360° C.
" II	·964	170° C.	" "
" III	·975	above 360° C.	" "
" IV	·947	"	" "

Three successive distillations were made on each of the four distillates; but it was found impossible to get a fraction having a definite boiling point, so they were not further distilled.

At this juncture it was decided to make an ultimate analysis of the fraction which was obtained between 115° C. and 265° C. under reduced pressure of 200 to 250 millimetres. For this purpose the upper layer of the fraction was removed and thoroughly dried with potassium carbonate to remove the adhering water, then decanted and redistilled under ordinary pressure. The distillate so obtained consisted of two layers, the lower of which was water.

This continued behavior of the gum in giving water on distillation therefore precluded the possibility of rectifying the oil after drying it with potassium carbonate, and it therefore became necessary to remove the supernatant layer, allow the water to separate, as nearly as possible, and then take the clear upper layer without rectification for combustion.

Several combustions were made upon this material with varying results that indicated as much as 4 to 5 per cent. of oxygen in the substance.

Considering the fact that it was quite impossible to completely remove the water from the fraction and the fact that some volatile gases were produced in the distillation of the liquids, the results of combustion might be looked upon as indicating a hydrocarbon. This view is strengthened by those combustion results whose carbon and hydrogen figures amounted to over 99 per cent.

Attention was then directed to the original material in order to determine its ultimate composition. As the gum could not be distilled without decomposition, it was necessary to dry it for several days at 110° C., in order to completely expel all adhering moisture.

During this drying the physical properties remained unaffected. Combustions were then made of the thoroughly dried material, with the following results:

	I.	II.	III.	IV.	Average.
Carbon	79·51	79·77	79·91	79·73	79·73
Hydrogen	12·04	12·77	11·29	11·53	11·91
Oxygen	8·45	7·46	8·80	8·74	8·36

These results indicate a substance with the following empirical formula: $C_{24}H_{40}O_2$; the percentage composition of this substance is:

C	79·97
H	11·14
O	8·89
	100·00

On account of the decomposition of the gum when heated, but little was learned, and it would be mere speculation to attempt to classify the gum by the foregoing formula.

Some of the gum upon which these results were obtained was distilled under ordinary pressure in the same manner that some of the undried gum had been treated.

The distillates contained water along with the hydrocarbon-like substance which distilled over.

The white vapors again filled the distilling apparatus, and the acrolein-like odors were again observed.

Combustion of the supernatant layers after drying with potassium carbonate showed increased amounts of carbon and hydrogen over those obtained from the original gum. In fact, the results at this point were practically the same as those obtained from the combustion made on the distillate obtained from the undried oil.

The distillates were tested for acrolein by shaking with water, separating the watery layer, making alkaline with ammonium hydrate, and heating with silver nitrate on a water bath. A reduction of the silver salt took place with the formation of a mirror on the sides of the test tube. The water, which had been agitated with the distillate, was also examined for formic acid by the mercuric chloride test. After keeping the test hot for some time no white precipitate was formed, indicating no reduction of the mercuric compound, and therefore an absence of formic acid.

It is believed, therefore, that acrolein is a product of decomposition of the gum during distillation. And it seems reasonable that the water which collects in the receiver during the distillation is also a product of decomposition.

These points, considered jointly, would seem to indicate some relation between the so-called gum and the higher fatty acids or fats, although the empirical formula found by combustion does not coincide with the general formula of the acids of either the paraffin, olefine, or acetylene series.

If we suppose it to be an acid similar to those just mentioned, the general formula of the class to which it would belong would be

$$C_nH_{2n-8}O_2.$$

The flash point of the gum was found to be 183° C., and its burning point 190° C.

Its iodine value was 46·39, and its saponification equivalent was 15·10.

ON THE ACTION OF SULPHURIC ACID UPON STRYCHNINE IN THE SEPARATION OF THIS ALKALOID FROM ORGANIC MATTER.[1]

By E. H. S. Bailey and Wm. Lange.

In the separation of the alkaloids from organic matter in the ordinary toxicological examinations, it has been found convenient to purify the alkaloid from the last portions of organic matter by evaporation of the partially purified material with a drop or two of strong sulphuric acid, and the question has arisen—to what extent does this operation destroy the alkaloid. The concentrated acid destroys the organic matter, and it would be strange if it did not,

[1] *Kan Univ. Quar.*, Vol. VI, No. 4, Oct., 1897, Series A.

under these conditions, partially destroy the alkaloid, or by hydrolysis or in some other way so change it that its presence could not be discovered by ordinary reagents. The object of these investigations was to determine, if possible, to what extent this process affected the delicacy of the tests for the detection of strychnine.

The method employed for separation of an alkaloid from organic matter is usually that of Stas, modified by later investigators as the conditions of the case may suggest. For the separation of strychnine, the best method has been found to be to acidulate with acetic acid, and digest at a moderate temperature with diluted alcohol. This alcoholic solution is then evaporated and an aqueous solution is obtained, which is made alkaline with caustic potash and shaken with chloroform several times; the chloroform solution is separated, and evaporated to dryness, and the residue, dissolved in a drop of dilute acetic acid, is tested for strychnine by the appropriate reagents. If this residue is still impure, it will become colored when the sulphuric acid is added to it, on account of the decomposition of organic matter, for pure strychnine salts and sulphuric acid give no coloration, or only the very faintest trace of color.

The color tests for strychnine are considered very satisfactory if carefully performed, and in connection with the precipitation by alkaloid reagents and the examination of the crystals by the microscope, and with the physiological test also, they can be depended upon to identify the alkaloid. Our experience has been that the most delicate tests could be made by the use of sulphuric acid and potassium bichromate. In this case the succession of colors, blue, purple and red is very characteristic. The color, with some other oxidizing agent, as manganese dioxide, is frequently of value as a confirmatory test, especially in the presence of other substances, such as caffeine. With this latter reagent the color reactions appear more slowly, but are just as definite finally.

In these experiments the delicacy of the color reaction with sulphuric acid and potassium bichromate was first established. In order to do this, solutions of strychnine of various strengths were prepared by dissolving a known weight of the alkaloid in acetic acid and water. The strength of these solutions varied from 1 grain of strychnine dissolved in 1,000 c.c. of water to 1 part in 1,000,000. One-tenth of a cubic centimetre of the solution, corresponding to one-tenth the weight of strychnine in 1 cubic centimetre, was evaporated to

dryness on a porcelain crucible cover, over a water bath, taking care to have all the strychnine deposited at one point on the cover. This residue was then moistened with 1 drop of concentrated sulphuric acid, and a minute particle of potassium dichromate was drawn through the droplet with a fine glass rod. This gave the characteristic color reaction. Beginning with a concentrated solution of strychnine, the tests were made in solutions of greater dilution till a point was reached at which it was not possible to detect the alkaloid by this test. The microscope was not used in the examination of the color test.

In the second series of tests, after evaporating the solution to dryness on the porcelain cover, it was treated with a drop of concentrated sulphuric acid, and heated for fifteen minutes on the water bath, then the test was made in the usual manner.

In the third series of tests the conditions were such as would prevail in the ordinary course of analysis, when organic matter is present. To each portion, before testing, a measured quantity of extract of beef was added, 25 c.c. of alcohol, and a few drops of acetic acid, and the whole was digested for an hour on a water bath. The mixture was then diluted, filtered, and evaporated to dryness on a water bath, allowed to cool and dissolved in water acidulated with a drop of acetic acid. The solution was made alkaline with potassium hydrate and shaken out twice with chloroform, about 10 c.c. of this solvent being used each time. The mixed chloroform solutions were then evaporated to dryness at 100° and the residue was moistened with a drop of sulphuric acid. This was warmed for fifteen minutes, then dissolved in water made alkaline with potassium hydrate and shaken out three times with chloroform. The mixed chloroform solutions were evaporated to dryness on a water bath, concentrating the residue to a small point on the porcelain surface, and the test was applied as in the preceding cases.

The results of these tests were as follows:

DELICACY OF THE CHEMICAL TESTS.

Fractions of a milligram present in the solution (x = limit, t = test).

0·1	0·05	0·033	0·025	0·020	0·016	0·011	0·005	0·003	0·0025	0·0020	0·0016	0·0014	0·00125	0·0011	0·001	0·0005	0·00033	0·00025	0·00020
Series I. Tests with the plain solution:																			
t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	x
Series II. Tests with strychnine and sulphuric acid:																			
t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	x				
Series III. Tests with strychnine, sulphuric acid and organic matter:																			
	t	t			x														

These experiments show that, though great care was exercised in the treatment of the residue, the action of the sulphuric acid decreases the delicacy of the reaction, so that although $\frac{25}{100000}$ of a milligram was detected in the original solution, after heating with sulphuric acid, only $\frac{11}{10000}$ of a milligram was detected. After the treatment with sulphuric acid and the shaking out with chloroform, it was not possible to find the strychnine except in a solution that contained $\frac{3}{100}$ of a milligram. It is evident that the treatment with sulphuric acid does diminish the delicacy, but that is not so large a diminution probably as the process of shaking out with chloroform. Although chloroform is an excellent solvent for strychnine, one part being soluble in eight parts of this menstruum, still so much of the strychnine is still retained in the organic matter that the portion that can be obtained from the chloroform solution is only a fraction of that which was originally present. It is probable that by more perfect extraction with chloroform, a greater quantity of strychnine can be obtained; but the experiments described above are made especially to show what will be the result, if the ordinary methods of extraction are followed.

ON THE USE OF ACETONE AS A SOLVENT IN PREPARING THE OFFICIAL RESINS.

By Edward T. Hahn.

Acetone is a good solvent for many organic substances, and is probably destined to replace alcohol and ether in many analytical and pharmaceutical processes. It is cheaper than either of these solvents. It is much more easily recovered from solutions than is alcohol. The loss through imperfect condensation in recovering it from solutions is less than that experienced with ether, and beside this advantage, acetone is not so inflammable as that very volatile fluid.

A few years ago, Mr. George M. Beringer[1] found that acetone could be satisfactorily used instead of ether for preparing the official oleoresins.

Later, in a paper on the preparation of the oak tannins, Messrs. Trimble and Peacock[2] showed that acetone could be employed to

[1] American Journal of Pharmacy, 1892; 145.
[2] American Journal of Pharmacy, 1893; 435.

advantage for the extraction of this class of proximate principles.

Prof. S. P. Sadtler[1] has proposed the use of acetone in the technical analysis of asphalt. And C. Kippenberger[2] has employed it as a solvent in volumetric determinations of alkaloids by means of Wagner's reagent.

In the work upon which the present article is based, the author endeavored to gain an idea of the value of acetone as a solvent in preparing some of the official resins. And it has been his especial purpose to compare acetone as a solvent in this connection with official alcohol. To accomplish this end, he extracted a sample of commercial powdered jalap with official alcohol, according to the directions of the United States Pharmacopœia; and, by following the subsequent instructions of that authority in regard to the precipitation and washing of the resin, he obtained a yield of 6·5 per cent. The quantity of powdered jalap operated on was 100 grammes. By substituting acetone for alcohol in the official process, he obtained a yield of 7·5 per cent. when working with 100 grammes of the drug.

Similar experiments with quantities of 100 grammes of powdered podophyllum yielded 4 per cent. of resin when alcohol was used, and 4·5 per cent. when acetone was employed. The foregoing results, therefore, show an increased yield when acetone is used. In extracting the resin from scammony, two lots of 10 grammes each were employed. One of these lots was treated with successive portions of boiling alcohol until exhausted. The other lot was treated in exactly the same manner with boiling acetone until exhausted. In both cases the solution of resin was evaporated to the same bulk and poured into equal quantities of water. The yield of resin was the same with the two solvents. It amounted to less than 60 per cent. for the drug in its original moist condition. After drying the sample of scammony to a constant weight, the yield of resin by the same method was found to be 63 per cent. by both solvents.

There was no marked difference in color between the samples of resin prepared from the same drug with the two solvents. The resins which were prepared by the use of acetone were found to be soluble in alcohol, and the reverse of this was true; those which were extracted with alcohol were soluble in acetone. This matter

[1] 1895, *Journal of the Franklin Institute*, **140**, 383.

[2] 1896, *Ztschr. anal. Chem.*, **35**, 10 and 422.

of solubility clearly indicates a great similarity in the products. It would appear from the results which the author has obtained that acetone might economically and conveniently replace alcohol in the preparation of the three previously named resins.

AN EXAMINATION OF SOME COMMERCIAL POWDERED EXTRACTS OF LICORICE.

By Calvin O. Kinzey.

Contribution from the Chemical Laboratory of the Philadelphia College of Pharmacy. No. 173.

The fact is well known that the powdered extract of licorice offered for sale in our markets is adulterated with such materials as starch, pea meal, sugar, etc., to a very large extent, and the extract can be readily adulterated with these materials without causing any very perceptible change in its appearance. It is evident that the evils arising from a practice like this will have a very bad effect on the market, and cause no small amount of loss and annoyance to purchasers.

While the value of extract of licorice depends altogether upon the amount of glycyrrhizin present, there seems to have been no effort made to establish a standard amount of this principle required in a good extract; furthermore, very little seems to have been written on the methods of assaying the extract of licorice for glycyrrhizin; and what has been written is rather vague regarding the solvent employed for dissolving the glycyrrhizin from the extract, and the details of reprecipitating the glycyrrhizin.

The author has lately had several brands of commercial powdered extract of licorice to estimate for glycyrrhizin, and he found himself confronted with the state of affairs already mentioned. Therefore, to estimate the samples, it became necessary to make some preliminary experiments, in order to devise a method that would afford comparative results.

The method which is ordinarily used in the estimation of glycyrrhizin is to exhaust the extract with either boiling water, cold water made alkaline with ammonia water, or with a cold mixture of water and alcohol, made alkaline with ammonia water. The insoluble matter is then filtered off, and the clear filtrate, containing the glycyrrhizin, is precipitated by making it acid, usually with dilute sulphuric acid.

During the course of these experiments, it was found that the method in which the ammoniacal water is used was not practical on account of the starchy materials present closing up the pores of the filter so the liquid could not pass through it. More success was had from the solvent containing alcohol, as the alcohol seemed to coagulate the starch to a sufficient extent to make it possible to filter off the insoluble part of the extract; but even under these conditions it required about twenty hours to effect filtration. An attempt was made to shorten the time required by using a suction pump, but this was found to be impracticable, on account of the filter clogging.

The following solvent for the extraction of the glycyrrhizin was found to give the most satisfactory results:

	c.c.
Official Ammonia Water	40
Official Alcohol	240
Sufficient Water to make a litre.	

METHOD OF ANALYSIS.

Moisture.—A weighed quantity (about 1 gramme) of the extract was put in a porcelain crucible, and dried in an air bath at a temperature between 100° and 110° C. The loss in weight was taken as the amount of moisture present.

Ash.—The residue remaining after treating as above was ignited to low redness over a Bunsen burner, until, on prolonged ignition, the weight remained constant. The residue gave the inorganic matter in the extract.

Insoluble Matter.—One gramme of the extract was carefully weighed, and treated in a beaker with 25 c.c. of the solvent previously mentioned. The mixture was stirred at close intervals during an hour, and then allowed to stand for about twelve hours, so that the insoluble matter could settle out. The supernatant liquid was decanted upon balanced filters, the residue in the beaker treated with 5 c.c. more of the solvent, allowed to settle again, decanted as before, and the insoluble matter transferred to the filter and washed until the washings passed through colorless. The filters and residue were then placed in an air-bath and dried at 100°–110° C.

Glycyrrhizin.—The filtrate from the above was acidified with dilute sulphuric acid, which precipitated the glycyrrhizin as a dark brown scale, which coagulated on standing. The precipitate was

collected on balanced filters, washed with water made slightly acid with acetic acid until all the sulphuric acid was washed out, and then dried in an air bath at 105° C., a higher heat being avoided on account of the liability of decomposing the glycyrrhizin above that point.

Two estimations were made on most of the samples, the figures given in the statement being the average of the two.

Manufacturer.	Brand.	Moisture.	Ash.	Insoluble Matter.	Glycyrrhizin.
1	Spanish . . .	6·52	3·70	36·52	6·40
2	Greek	6·26	8·18	22·06	14·39
2	Spanish . . .	5·00	5·51	25·54	10·75
3	American . . .	5·62	6·79	12·27	7·63
3	Spanish . . .	7·08	6·52	29·20	5·28
4	Spanish	6·96	6·56	20·35	10·41
4	Greek	6·71	7·82	9·65	18·59
5	—	7·96	5·77	15·21	8·90
5	—	8·25	5·54	7·40	27·78
5	—	8·46	4·67	19·41	9·50
5	—	9·19	6·76	11·12	8·94
6	—	5·78	7·49	5·95	11·63

THE CHEMICAL ANALYSIS OF THE GASTRIC CONTENTS.[1]

I. Method of Analysis for Use in Clinical Work.

II. Record of the Analyses of the Gastric Contents of Fifty Healthy Individuals.

By Henry F. Hewes, M.D.,
Assistant in Chemistry, Harvard Medical School, Boston.

I. METHOD OF ANALYSIS FOR USE IN CLINICAL WORK.

To the physician who would utilize the investigation of the products of gastric digestion, as an aid to the diagnosis and treatment of his cases, there are two requisites. These requisites are: (1) a reliable method of investigation; (2) a series of results for comparison, obtained by the application of this method to the product of the normal gastric digestion.

The development of a systematic method of investigation is dependent upon the collected knowledge of the subject of gastric

[1] From *Boston Medical and Surgical Journal*, November 25, 1897.

digestion in health and disease. This knowledge is, stated briefly, as follows:

The digestion of food in the stomach occurs through the agency of a mineral acid (hydrochloric acid), a proteolytic ferment (pepsin) and a coagulating ferment (rennin), all produced from the glands of the mucous membrane of the stomach. Under the combined action of these physiological agents the proteid elements of the ingested food are digested.

The secretion of the hydrochloric acid begins immediately upon the ingestion of the food. The secreted acid at once combines with the native proteids of the food, forming acid proteids. It also acts upon the pepsinogen in the gastric glands forming pepsin.[2] The secretion of the acid continues until the affinities of the native proteids for acid being satisfied, a certain amount of superfluous (free) hydrochloric acid obtains in the stomach.

Coincident with the appearance of this free hydrochloric acid, the activity of the pepsin ferment begins.[3] Under the influence of this pepsin in free HCl, the acid proteid products are converted with increased rapidity to albumoses and peptones. The rennin ferment is produced from the beginning of digestion, in part existing preformed in the cell of the mucous membrane, in part being formed by the action of the secreted acid upon the rennet zymogen. Under its influence the casein of food is digested to a coagulated and a soluble proteid.[4]

The products of digestion are in part absorbed, in part expelled in small quantities during the process of digestion. The greater part of the contents is, however, expelled *en masse* into the duodenum at the completion of digestion (Richet and Kühne). Whatever products are absorbed are replaced by water secreted by the stomach.

The mixed contents of the stomach will contain in the earlier stage of digestion:

(1) The elements of the ingested food, proteids, albuminoids, carbohydrates, fats, mineral and organic salts and extractives.

(2) The acid proteids and acid salts, the products of the combination of the secreted hydrochloric acid with the proteids and mineral salts of the food.

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[2] Langley: *Journal of Physiology*, Vol. III and Vol. VII.

[3] Boas: Diagnostik d. Magenkrankheiten, Leipzig, 1890, s. 118.

[4] Hammarsten: Maly's Jahresbericht, Vol. II, p. 118; Vol. IV, p. 135; Vol. VII, p. 158.

(3) The ferments, pepsin and rennin and the rennet zymogen.

(4) The products of the action of rennin upon casein. The principal proteids present are the native proteids and the acid proteids.

In the later stage of digestion the contents will contain the above substances except the organic salts, and, in addition, free hydrochloric acid and certain organic acids due to the action of the free HCl upon the organic salts of the food.[5]

The principal proteid substances present are albumoses and peptones.[6, 7]

In pathological conditions of the stomach we may find absence or diminution of one or more of the physiological agents of digestion; and, in addition, the presence of certain abnormal substances not produced in the normal organ. These last substances are principally certain organic acids, lactic acid, butyric acid, acetic acid.

These substances are present in the normal contents only in the amount in which they or their salts are contained in the ingested food. In pathological conditions of the stomach they may be produced in considerable amounts as a result of the fermentation of the foods, principally the carbohydrate foods.

The particular fate of the different food elements in the stomach is as follows:

The native proteids are transformed in turn to albuminates, albumoses and peptones.

The albuminoids are, to some extent, digested; to some extent remain unaltered; thus gelatin is transformed to gelato-peptone, keratin is unchanged.[8, 9]

The carbohydrate food is not digested by the agents of gastric digestion. The hydrochloric acid of the gastric juice has the power of inverting cane sugar, but aside from this the gastric secretions exert no influence upon the carbohydrates.[10] A certain amount of amylolytic digestion does, however, occur in the stomach under the influence of the ptyaline of the saliva brought into the stomach with the food. The digestion of cooked starch goes on in

[5] Richet: Le Suc Gastrique, Paris, 1878. Gamgee: Physiological Chemistry, Vol. II, p. 158.

[6] Boas: *Zeitschr. f. klin. Med.*, B. 12, s. 244.

[7] Cahn: *Zeitschr. f. klin. Med.*, B. 12, s. 34.

[8] Tatarinoff: *Centralbl. f. d. med. Wassenschaft*, No. 16, 1887.

[9] J. de Bary: Hoppe-Seyler's Untersuchung, H. I, p. 75.

[10] Leube: Virchow's Archiv, Bd. 88, s. 222.

the stomach through the influence of this ptyaline until inhibited by the increasing acidity of the contents.[11, 12]

The fats are not digested in the stomach. The proteid envelopes of the fat cells are digested away, allowing the fat globules to run together, and thus preparing the fat for the action of the intestinal digestion.[13]

The duration of digestion in the stomach, the rapidity of the appearance of free hydrochloric acid in the contents, and the quantity of the secretion of the physiological agents necessary for complete digestion are directly dependent upon the quantity and quality of the food.[14]

Thus 100 grammes of raw beef *plus* 300 c.c. of water are digested in two hours.[15] The same amount of beef roasted takes three hours. The duration of the digestion of an Ewald test breakfast (one roll, weight 35 grammes, and 300 c.c. of water) is from two to two and one-half hours. The digestion of a Leube meal (soup, meat and bread) is from six to seven hours.[16]

Free hydrochloric acid appears in the normal stomach from fifteen to twenty minutes after the ingestion of 35 grammes of bread with water; twenty-five to thirty-five minutes after the ingestion of twice this amount (70 grammes); twenty-five to thirty-five minutes after 60 grammes of meat; sixty to ninety minutes after egg albumin; forty-five minutes after a mixed meal of bread, meat and vegetables. The addition of fat to a meal delays the appearance of ree HCl. The replacing of a certain amount of meat by a potato delays the appearance of the HCl.

The total amount of the free hydrochloric acid may rise after a light meal (Ewald meal) to 2·2 grammes per mille, after a full meal (Leube) to 3·3 grammes per mille.[17] This maximum mark is

[11] Ptyaline digests cooked starch to dextrin and maltose at the body temperature in neutral, alkaline or faintly acid solutions. Chittenden: *American Chemical Journal*, Vol. III; Studies from Yale Laboratory of Physiological Chemistry, 1884-85.

[12] The action of ptyaline is inhibited in an acidity of ·14 per cent. free HCl, ·27 per cent. combined HCl. Langley: *Journal of Physiology*, Vol. III.

[13] Cash, Archiv f. Anat. and Physiol., 1880, claims that small quantities of the fats are broken up by the action of the HCl to fatty acids.

[14] Ewald and Boas: Virchow's Archiv, Vol. CI, s. 3 5.

[15] Lassen: *Zeitschrift f. Biologie*, Vol. XIX.

[16] Leube: Deutsches Archiv, Bd. XXXIII.

[17] Ewald: Klinik der Verdauungskrankheiten, Vol. II.

reached from one to one and one-half hours after an Ewald meal, from two to three hours after a Leube meal.

Upon the facts contained in this review of the function of gastric digestion is based the method of investigation. It is clear, from this review, that the important points to be investigated are: The presence and amount of the physiological agents of digestion; the evidence of their action upon the food; and the presence or absence of certain abnormal products. We have found that the time of the appearance of these agents and the amounts of them secreted vary according to the quantity and quality of the food ingested. To judge of the status of these agents in a given case, therefore, we must obtain the contents of the stomach in that case at a given time after a definite meal, subject these contents to a systematic examination, and compare the results of this examination with standard results obtained from an investigation of the contents of the normal stomach in a series of cases under the same conditions.

The first step in the development of the method is the choice of the meal. This test meal should contain the ordinary elements of mixed food, that is, proteids, albuminoids, carbohydrates and fats. It should also contain none, or as small amounts as possible, of those substances the production of which is peculiar to the pathological conditions of the stomach, that is, lactic, butyric and acetic acids.

Of the meals which have been proposed as test meals, we may mention those of Ewald,[18] of Leube and Riegel,[19] of Reichman,[20] of Jaworski,[21] of Klempere,[22] of Boas.[23] Two of these only are in common use for general work, that of Ewald and that of Leube and Riegel.

The Ewald test breakfast consists of one baker's roll, weight about 35 grammes, and 300 c.c. of water, or of tea without milk or sugar. According to König's analysis, such a roll contains 7 per cent. of nitrogen, ½ per cent. of fat, 4 per cent. of sugar, and 52·5 per cent of non-nitrogenous extractive substances, to which 1 per cent. ash must be added.[24]

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[18] Klinik der Verdauungskrankheiten, Vol. II, s. 14.

[19] See below.

[20] Reichman's meal: meat fonder 30 grammes, 1 roll, water 200 c.c., salt 2 grammes.

[21] *Zeitschr. klin. Med.*, Bd. XI, s. 275.

[22] Ewald: *Berl. klin. Woch.*, 1886, No. 3.

[23] *Deutsch. med. Woch.*, No. 39, 1893.

[24] Ewald: *Loc. cit.*

This meal thus contains the various nutritious ingredients, albuminoids, starches, sugars, plant albumins, salts and fat.

The Leube meal consists of 400 grammes of soup, barley or flour soup, 60 grammes scraped beef, 50 grammes of wheat bread, and 200 c.c. of water.

The use of both these meals may be necessary—in some cases one, in some the other, in some both. In a majority of cases, however, but one meal has to be resorted to; and for this general work the Ewald meal is the superior. This superiority of the Ewald meal is based upon the following comparative data:

(1) The Ewald meal contains lactic acid, if at all, in amounts too small to react to the ordinary approved tests.[25] The Leube meal, on the other hand, contains a considerable amount of lactic acid.[26] As the production of lactic acid in the stomach is a symptom of pathological conditions, we have thus, in the presence of this acid after the Ewald meal, positive evidence of abnormal conditions, which evidence cannot be obtained by the use of the Leube meal.

(2) The quantitative results in regard to the amount of the hydrochloric acid secreted and the period of the appearance of the free hydrochloric acid vary within much more extended limits in the normal after a Leube meal than after an Ewald.[27, 28]

The considerable amounts of organic acids and acid salts which may be present in the Leube meal make rough estimations of the hydrochloric acid less reliable and accurate estimations more laborious than with the Ewald meal, with its insignificant amount of these substances.

A fourth advantage of the Ewald meal lies in the fact that it can be taken by patients with disordered digestive functions with much less difficulty than the Leube.

It is true that the Ewald meal is not as strong a test of the diges-

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[25] The finding of lactic acid in the normal contents, as reported in many cases by old methods, is of no account, as the methods have been proven inaccurate; Rosenheim: *Zeit. klin. Med.*, Bd. XXVIII, 1895.

De Jong: Archiv. Verdauungskrankheiten, Bd. II, H. 1.

Langruth: Archiv. Verdauungskrankheiten, Bd. I, s. 305.

[26] Langruth: *Loc. cit.*

[27] Rosenheim: Pathologie u. Therapie—Speiserohre in Magenskrankheiten.

[28] Einhorn: *Berlin. klin. Woch.*, 1888, No. 32. In a series of investigations of the normal digestion with both the Ewald and Leube meals, found the results obtained by the Ewald meal much more constant.

tive function as the Leube. A patient might have sufficient digestive capacity to completely digest an Ewald meal, and yet not sufficient to digest the ordinary mixed meal taken by a person of health and vigor. If this is the case, the deficiency will appear in the quantitative results obtained after the Ewald meal. And where such a condition is suspected or indicated, a Leube meal can be given after the Ewald test has been applied.

The Ewald test breakfast is given on a fasting stomach. Thus the meal may be given at 8 A.M., the patient having fasted since the dinner of the night before.

One hour after ingestion of the meal, the stomach tube is passed and the contents expressed.

The choice of one hour as the period of elapsed digestion before expression is founded upon experimental research. The most complete information can be secured if the contents be obtained at the period when all the physiological agents of digestion are present and active, and when the quantity of these approaches the maximum. This period has been found to be practically one hour after the ingestion of the Ewald meal.

As it is impossible, in ordinary clinical work, to obtain the contents in each case at exactly one hour after ingestion, I have this year made an investigation for the purpose of determining the effect of a longer interval than one hour upon the results in regard to the important conditions investigated.

The investigation consisted of the examination of the contents expressed one hour after an Ewald meal in fifteen normal cases, and an examination of the contents expressed one and one-half hours after this meal in fifteen cases. The results may be seen in the following table of averages:

TABLE I.

	1 Hour.	1½ Hours.
Average quantity of mixed contents	120 c.c.	100 c.c.
Average total acidity	2 gm. p.m.	2·01 gm. p.m.
Starch present	2 cases.	2 cases.
Erethrodextrin present	8 "	6 "
Albumin present	15 "	15 "
Free HCl present	15 "	15 "
Lactic acid present	0 "	0 "

The conclusion to be drawn from these results is, that the conditions, the estimation of which is of importance in clinical work, do

not vary in the period between one hour and one hour and a half after ingestion of the food, to an extent sufficient to affect the significance of the results.

For practical work, then, the contents may be expressed at a period between one and one and one-half hours after ingestion of the meal.[29]

The tube used is a soft rubber tube, 75 to 90 centimetres in length. The end of this tube is introduced to the pharyngeal end of the esophagus and swallowed by the patient. When the tube has reached the stomach the contents are expressed.[30]

The simplest method of expression is that suggested by Ewald. This consists of pressure of the hand upon the epigastrium, and forced vomiting by the patient. The end of the tube is moved up and down in the stomach during the expression. As a rule, practically all of the contents can be obtained by this method. I have repeatedly tested its efficiency by following the expression with siphonage by the introduction of water.

Another excellent method of expression is aspiration. An aspiration bulb, with a short rubber tube on each end, is attached to the stomach tube. By alternate compression and expression of the bulb, under the control of appropriate stopcocks, the contents may be successfully aspirated.[31]

The expressed contents are measured, mixed thoroughly and subjected to the chemical analysis. The aim of this analysis is:

(1) The detection of the presence of the physiological agents of gastric digestion—the hydrochloric acid, pepsin and rennin.

(2) The determination of the quantity of these agents.

(3) The detection of certain abnormal products peculiar to definite pathological condition, if present—as lactic acid.

(4) The testing of the digestive capacity of the contents as removed.

The reason for these determinations and their value is clear from the consideration of the digestive function which has preceded. The integrity of the function is dependent upon the presence and sufficient amount of the physiological agents.

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[29] Cases of excessive activity of digestion are reported with disappearance of contents within one and one-half hours.

[30] The distance from the incisor teeth to the fundus of the stomach is about 23 to 26 inches.

[31] Boas: Magenkrankheiten, s. 104.

The failure of any agent, or of its normal amount, may, at the same time, point to the malady in a given case, and suggest a treatment.

The presence of the abnormal substances not produced in the normal stomach is itself an indication of a pathological process, and, to some extent, of the nature of this process.

Of secondary value may be the determination of the separate products of the proteid and carbohydrate digestion in the stomach.

Some writers ascribe considerable importance to these tests, especially the tests for starch and dextrin in the gastric contents; but recent works and my own observations, given later in this paper, tend to show that very little, if any, useful information can be obtained by these tests.[32]

In detail, the chemical analysis includes the following determinations:

The reaction.

The presence of free acids.

The qualitative determination of free hydrochloric acid, lactic acid, butyric acid, acetic acid, pepsin, rennin and the zymogen.

The quantitative determination of the total acidity, and of the total hydrochloric acid and of its factors, the total free and total combined HCl.

The determination of the digestive capacity of the contents.

In certain cases the following determinations may be useful, in addition to the above test:

The qualitative determination of starch, erethodextrin and achrodextrin.

The qualitative determination of native proteids, acid albumin, albumoses and peptones.

The quantitative determination of the total organic acids.

The quantitative determination of the total acid salts.

The determinations of the hydrochloric acid of the contents include:

(1) The detection of free hydrochloric acid.

(2) The quantitative estimation of the total free hydrochloric acid.

(3) The quantitative estimation of the total combined hydrochloric acid.

[32] See Ewald: Klinik der Verdauungskrankheiten, Vol. II, s. 51.

(4) The quantitative estimation of the total secreted hydrochloric acid, that is, the free *plus* the combined hydrochloric acid.

The hydrochloric acid secreted by the stomach during digestion is disposed of in four ways. One portion combines with the inorganic bases of the food or of the saliva.

As the Ewald meal is in infusion acid, the amount of acid used in this way in cases examined by this method is practically that necessary to neutralize alkaline salts of the saliva.

This portion of the hydrochloric acid is not adaptable for the digestion of the food, and does not appear in the quantitative determinations of acidity.

A second portion combines with the proteid or albuminoid substances, either normal in the stomach, as mucin, epithelial cells, pepsinogen, rennin zymogen, or produced there in pathological conditions.

A third portion combines with the organic bases of the food, the proteid elements—to form acid proteids.

A fourth portion, which appears only when the first three portions are completed, exists as free acid.

These last three portions make up the total acid adaptable for purposes of digestion. They all appear in the quantitative determination of the hydrochloric acid—the first two as combined acid, the third as free acid.

The purely digestive function of the hydrochloric acid is, then, (*a*) to completely combine with the proteid food elements; (*b*) to combine with the pepsinogen and rennin zymogen, to liberate the ferments; (*c*) to serve as free acid, as a menstruum for the action of the pepsin upon the acid proteid combinations.

The object of our analysis in a given case is to determine if a sufficient amount of hydrochloric acid is secreted to perform this function.

From what has been said concerning the action of the acid, it is clear that this object is in some measure attained by the determination of the presence in the contents of free hydrochloric acid. Free acid present, we have the proteid affinities saturated, the ferments liberated and the conditions for peptic digestion present.

Even with free acid present, however, a more definite knowledge of the comparative vigor of the digestive function in a given case can be obtained by the determination of the total hydrochloric acid.

Thus, of two cases, both containing free acid, one may contain only enough acid to give a small amount of free acid, the other enough to give a large amount. The second condition is, within certain limits, indicative of a more vigorous function and greater reserve force.

In cases where no free hydrochloric acid is present, a quantitative estimation is our only method of determining how great a degree of hyposecretion is present.

For satisfactory work, therefore, both a qualitative test for free hydrochloric acid and a quantitative estimation of the total hydrochloric acid are necessary.

For the determination of the presence of free hydrochloric acid there are four good tests suited to practical work; these are Gunzburg's phloroglucin-vanillin test, Boas's resorcin test, Töpfer's dimethyl-amido-azo-benzol test, and the oo Tropeolin test.

Gunzburg's reagent consists of phloroglucin 2, vanillin 1, absolute alcohol 30.[33] One drop of the contents is heated on a white dish over a water-bath, and one drop of the reagent added. If free hydrochloric acid be present, a red zone of crystals is formed.

Boas's reagent consists of resorcin 5, sacch. alb., 3, spiritus dil. ad., 100. The test is performed in a manner similar to that described for the Gunzburg. Free hydrochloric acid gives a purple-red color.[34] These two reagents, the Boas and the Gunzburg, give no reaction whatsoever with organic acids, and are not interfered with by peptones or acid salts.

The oo Tropeolin test consists of the addition of one drop of a saturated alcoholic solution of oo tropeolin to one drop of the contents over a water-bath. Free hydrochloric acid gives a deep bluish-purple color. Organic acids give an orange color; acid salts a tawny yellow.

Töpfer's reagent consists of ½ per cent. alcoholic solution of dimethyl-amido-azo-benzol. One drop of this reagent is added to a portion of the contents in a test-tube. If free hydrochloric acid be present a carmine-red color appears. This reagent gives a brownish-red color with organic acids.[35]

All four tests are of about equal delicacy in testing straight solu-

[33] *Centralblatt f. klin. Med.*, No. 40, 1887.

[34] Boas: Diagnostik, 2d Auflage, 1891, s. 134.

[35] Töpfer: *Zeitsch. f. Physiolog. Chemie*, 1894, Bd. XIX, H. 1, s. 104.

tions of hydrochloric acid. Where the acid is mixed with other substances, particularly with organic acids, as in the gastric contents, this equality of the different tests does not hold. In cases where considerable amounts of organic acid are present it is impossible to make an accurate reading from the Töpfer test. In other cases, owing to conditions not thoroughly understood, the Gunzburg test will react, while the oo Tropeolin fails, or the Töpfer test works where the Boas fails, or *vice versa*. It is my custom in general work to depend upon all four reagents. The Gunzburg test I have found the most satisfactory for the varying conditions. I therefore test the contents first with this test. If it reacts, free hydrochloric acid is present. If it fails, the Boas, Töpfer and oo Tropeolin tests are tried in turn. It is only when a positive test is lacking with all four that free hydrochloric acid is recorded absent.

The methods for the quantitative determination of the hydrochloric acid are of several kinds. Three type methods serve to illustrate the different principles employed in the various methods:

(1) Methods based upon the determination of the total hydrochloric acid by precipitation and estimation of the total chlorine present.

(2) Methods based upon the determination of the total HCl by estimation of the acidity of the ash.

(3) Methods based upon the determination of the total HCl by the reaction of color reagents.

The precipitation method is best represented by the method of Martius and Luttke, which is the most accurate of all the methods of this class.[36] This consists of the estimation of the total hydrochloric acid by determination of the total chlorine of the ash not present in the form of chlorides. This method, as all the accurate methods of this class, is too difficult for clinical work.

The second type of method is represented by the method of Seeman.[37] This method consists of (*a*) the neutralization of the total acidity of the contents with soda solution, in known amount; (*b*) the reduction of the contents to the ash, thereby driving off all the organic compounds; (*c*) the estimation by titration with decinormal acid solution of the acidity lost by this reduction; (*d*) the estimation of the total hydrochloric acid by subtraction of the lost organic

[36] Martius u. Luttke: Magensaure d. Menschen, Stuttgart, 1892.

[37] Seeman: *Zeitschr. f. klin. Med.*, Bd. V, s. 273.

acids total from the total acidity. This method is very simple. It is not, however, absolutely accurate, since the total acidity due to acid salts is contained in the total recorded as total hydrochloric acid.[38]

A review of all these precipitation and ash methods produced up to 1891 may be found in Martius and Luttke's "Magensaure d. Menschen."

The method of the estimation of the total hydrochloric acid by color analysis includes the following determinations:[39]

(*a*) The determination of the total acidity by phenolthalein.

(*b*) The determination of the total acidity due to free acids and acid salts by alizarin or Congo red.

(*c*) The determination of the total combined acids by subtraction of *b* from *a*.

(*d*) The determination of the total free hydrochloric acid by phloroglucin-vanillin or di-methyl-amido-azo-benzol.

(*e*) The determination of the total hydrochloric acid by the addition of *c* and *d*.

This color-analysis method has not the absolute accuracy of the precipitation methods.

It is, however, of sufficient accuracy for comparative work, and has the advantage of a simplicity fitting it for ordinary clinical work.

The details of this color-analysis process are as follows: The estimations are all made by titration of the contents with a decinormal solution of sodic hydrate.[40] Each cubic centimetre of this soda solution is capable of neutralizing 0.00365 gramme of hydrochloric acid. The estimation of the total acidity (*a*) is made by titration against the indicator phenolthalein. This reagent gives a red color in an alkaline solution, no color in acid solution. Ten cubic centimetres of the mixed contents are diluted with water, and two or three drops of a 1 per cent. alcoholic solution of phenolthalein added. To this mixture the decinormal soda solution is added from a graduated burette until a definite red color appears and remains

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[38] Hari: Archiv f. Verdauungskrankheiten, Bd. II, H. 203.

[39] This plan of analysis is that originated by Töpfer, with some modification of the tests. Töpfer: *Zeitschr. f. Physiol. Chemie*, Bd. XIX, H. 1.

[40] One-tenth molecular weight of NaOH + 1,000 c.c. distilled water = 4 grammes to 1,000 c.c.

after shaking. The presence of the red color shows that all the acid present has been neutralized.

By multiplying the number of cubic centimetres of decinormal soda solution used (x) by 0·00365 gramme, we obtain the total acidity, in equivalents of hydrochloric acid, of the 10 cubic centimetres of contents, and from this result the per cent. or per mille amount of acid is estimated.

The estimation of the total acidity due to free acids and acid salts (b) is performed in the same manner, using Congo red as the preliminary indicator and alizarin as the final indicator.

Congo red paper, prepared by dipping filter paper into a strong aqueous solution of Congo red, turns a clear blue color in the presence of free HCl, purple in the presence of organic acids, and a dull brown with acid salts. In the presence of combined acids it does not change color. In this test the decinormal solution is added to a given amount of the contents until a drop of the mixture fails to give any change of color to the Congo red. The reading taken at this point is recorded as the preliminary record of the amount of free acids *plus* acid salts present.

An aqueous solution of alizarin monosulphonate of soda (1 per cent.) of a yellowish color gives no change of color when added to a solution containing free acids or acid salts, but gives a purple color in alkaline solution or in an acid solution, the acidity of which is due to combined acids alone. Decinormal soda solution is added to a portion of the contents, to which two or three drops of a 1 per cent. solution of alizarin has been added, until a purple color is obtained. The appearance of this color marks the neutralization of the free acids and acid salts. It is the final record of the amounts of these substances.

The alizarin test is the more accurate, and should be taken as the final index, where it is possible to get an accurate result with it.

The reason for employing both the Congo red and alizarin in this estimation is that it is impossible in some cases to make an accurate reading by the alizarin test, the point of transition from a yellow to a purple color not being abrupt.[41]

In such cases the record by the Congo red test must be used. The reading by this test will always be less than the alizarin test by about 0·1 to 0·3 c.c. decinormal solution to 10 c.c. contents, as the

[41] Mohr: *Zeitsch. f. Physiolog. Chemie*, Bd. XIX, H. 6, s. 67.

first records the end of the acid reaction, while the latter records the actual alkaline reaction.

By the subtraction of the total acidity due to free acids *plus* acid salts (*b*) from the total acidity (*a*), the acidity due to combined acids is obtained (*c*). Where free hydrochloric acid is present, all of the combined acid is combined hydrochloric acid, whatever organic acids may be present.[42]

The estimation of the total free hydrochloric acid (*d*) is performed by titration with the decinormal soda solution until the test for free HCl can no longer be obtained. Ten cubic centimetres of the contents, to which two drops of the ½ per cent. alcoholic solution of di-methyl-amido-azo-benzol have been added, are titrated with the soda solution until the red color of the mixture gives place to a yellow color. This point determines the neutralization of the free HCl. This is the simplest method of performing this test. It has, however, one great disadvantage as a test for general use. Where any considerable quantity of organic acids is present in the contents, the point of transition from a carmine-red to a yellow color is not sharp and cannot be accurately determined.[43] The organic acids give a brownish-red color, which is not unlike the much diluted carmine red of the mineral acids.[44] For this reason I have used phloroglucin-vanillin as the indicator in place of or in addition to Töpfer's reagent. The test with this reagent can never be confused by the presence of organic acids or other constituents of the gastric contents. Ten cubic centimetres of the contents are titrated with the soda solution until a drop of the mixture fails to give the free HCl reaction with phloroglucin-vanillin. The last reading before the failure of the test is taken as the measure of the hydrochloric acid. Thus, if the test responds after the addition of 4 c.c. one-tenth soda solution and fails with the addition of 4·1 c.c., the free HCl in the 10 c.c. of contents = $4 \times .00365$ gramme.

The total hydrochloric acid (*e*) is determined by the addition of the total combined HCl (*c*) and the total free HCl (*d*), in cases where free HCl is present. Where no free HCl is present the total hydrochloric acid can be estimated by the following method (Mintz method):

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[42] Boas: *Loc. cit.*

[43] Hari: Archiv f. Verdauungskrankheiten, Bd. II, H. 203.

[44] Strauss: *Deutsches Archiv f. klin. Med.*, Bd. LXVI, H. 1.
Mohr: *Loc. cit.*

To 100 c.c. of the contents add a decinormal solution of hydrochloric acid until the test for free HCl with phloroglucin-vanillin is obtained. Since the limits of the Gunzburg reaction is 0·036 gramme per mille HCl (that is, 1 c.c. decinormal soda solution to 100), the difference between this figure and the amount of decinormal soda solution used represents the amount of combined HCl present in the 100 c.c. of contents, that is, the total hydrochloric acid present. For example, if Gunzburg's reaction were first positive after the addition of six-tenths of a cubic centimetre decinormal HCl solution to 100 c.c. contents, then 1 — 0·6 = 0·4 c.c. one-tenth normal HCl is the amount of HCl already present in 100 c.c. of contents. This process can be conducted with less than 100 c.c., if necessary.

The total combined acid (*c*) in cases where no free HCl is present represents the sum of the combined hydrochloric and combined organic acids. Where no organic acids are present by the qualitative tests, the total combined acid (*c*) may be taken approximately as the total hydrochloric acid in these cases.[45]

As an example of the application of this method, I give the results of the examination of the contents of a normal stomach—contents expressed one hour after an Ewald test meal.

Amount of contents, 160 c.c.

Amount of filtrate, 85 c.c.

A. Ten cubic centimetres mixed contents *plus* two guttæ phenolthalein gave red color on addition of 7 c.c. decinormal soda solution. . · . Total acidity of 10 c.c. contents = 7 × 0·00365 gramme = 0·02555 gramme HCl = per mille $\frac{1000}{10} \times 0{\cdot}02555$ = 2·55 grammes.

B. Ten cubic centimetres contents with Congo red paper fail to give change of color at 4·7 c.c. decinormal NaOH. . · . 1·71 grammes per mille HCl = preliminary record total free acids *plus* acid salts. Same 10 c.c. contents give purple color with alizarin on addition of 4·9 c.c. NaOH solution. . · . Total acidity due to free acids *plus* acid salts in 10 c.c. = 4·9 × ·00365 = 1·78 grammes per mille (final record).

C. Total combined acid = *A* — *B*, that is, 2·55 — 1·78 = 0·77 per mille.

[45] The qualitative tests for lactic and butyric acids, etc., react to lactates and butyrates, as well as the free acids.

D. Ten cubic centimetres contents titrated with NaOH failed to give red color with phloroglucin-vanillin, first, on addition of 3·2 c.c. NaOH solution — responded with 3·1 c.c. . . . Total free HCl = 3·1 × ·00365 × 100 = 1·13 grammes per mille.

E. Total hydrochloric acid = $C + D$, that is, 0·77 + 1·13 = 1·90 gramme per mille.

F. Total acidity due to organic acids *plus* acid salts = $B - D$, that is, 1·78 — 1·13 = 0·65 gramme per mille.[46]

The whole process of quantitative determination by this method can be accomplished with simple apparatus within twenty minutes.

The results, though not of absolute accuracy, are accurate for comparative work. For example, the delicacy of the test for free HCl is ·05 gramme per mille. The total free HCl is thus for 3·1 c.c. NaOH solution not 1·13 per mille, but 1·13 + 0·05 per mille. Also the error incident upon the judgment of colors must affect the results in this method for absolute work. The above sources of error are, however, constant in comparative work, and thus do not affect the results.

A certain amount of the secreted HCl combines with the phosphates of the food, forming acid phosphates, which contribute to the sum of the total acidity of the contents. In some cases it may be useful to estimate these total acid salts and the total organic acids separately. This may be accomplished by the addition of the following method (Leo's method) of estimating the total acid salts to the scheme of analysis already given.[47]

To 15 c.c. contents add 1 gramme dry powdered $CaCO_3$; shake; filter. Measure off 10 c.c. of filtrate; pass a stream of hot air through it to carry off the CO_2; add 5 c.c. $CaCl_2$, add one drop of phenolthalein, and titrate with decinormal soda solution. The total acidity of this last filtrate divided by 2 is the total acid salts contained in the 10 c.c. of contents. The $CaCO_3$ unites with all the acid elements of the contents save the acid salts, forming of the HCl calcic chloride, of the lactic acid lactate of calcium, etc. In the presence of the $CaCl_2$ thus formed twice the amount of decinormal

[46] If the acid salts are computed by the method given below, we get the following addition to the above record: G total acid salts subtracted from B_2 (total free acids and *plus* acid salts in mixture with $CaCl_2$ = total free acids (H). Subtract total free HCl D from total free acids (H) — total organic acids (K).

[47] Leo: Krankheiten der Verdauungs Organ, Berlin, 1890.

soda solution is necessary to neutralize the acid phosphates, as in the absence of $CaCl_2$; hence the division by 2 of the final result.

If this total acid salts (G) be subtracted from the total of organic acids *plus* acid salts obtained as described above, but after the addition of 5 c.c. of concentrated solution of $CaCl_2$ to the 10 c.c. of contents (B_2), we have, as a result of our subtraction, the total organic acids (see addenda to analysis).

This plan of analysis is, as I have stated, a modification of the method published by Töpfer.[48] The modifications consist in:

(1) The addition of the Congo red test for free acids and acid salts to the alizarin test as given by Töpfer, in the quantitative estimation of these substances.

(2) The substitution of the phloroglucin-vanillin test for HCl, for the di-methyl-amido-azo-benzol test of Töpfer in the quantitative estimation of the HCl.

The reasons for these changes are given in the description of the methods (see preceding pages). As I have stated in the description referred to, the Töpfer tests are satisfactory for a majority of cases examined, but not for many cases, especially those with pathological conditions. The objections to the tests cited are based upon the researches of Hari,[49] Strauss,[50] Mohr,[51] and upon my own experience in analyses of the gastric contents.

The pepsin of the gastric juice is produced from the pepsinogen formed in the glands of the gastric mucous membrane by the action of free hydrochloric acid upon this pepsinogen.[52] Since pepsin may be found in gastric contents containing no free hydrochloric acid, it is probable that the secreted acid has combined with the pepsinogen before the affinities of the proteid foods are satisfied.[53]

The pepsin acts only in the presence of free hydrochloric acid. The evidence of the presence of pepsin in the contents of a given case is assured by the capacity of this contents to digest albumin.

If free hydrochloric acid be present, the determination of the

[48] Töpfer: *Zeitschr. f. Physiol. Chemie*, Bd. XIX, H. 1.

[49] Hari: Archiv f. Verdauungskrankheiten, Bd. II, H. 203.

[50] Strauss: *Deutsches Archiv f. klin. Med.*, Bd. 56, H. 1.

[51] Mohr: *Zeitschr. f. Physiolog. Chemie*, Bd. XIX, H. 6, s. 6, H. 7.

[52] Langley: *Journal of Physiology*, Vol. VII, p. 391, and Vol. III, p. 269.

[53] Hammerschlag (Archiv f. Verdauungskrankheiten) finds considerable amounts of pepsin in cases with no free HCl.

pepsin is conducted as follows: 50 milligrammes of coagulated egg albumin are placed in 25 c.c. of the filtrate of the contents, and the mixture kept at a temperature of 40° C. If pepsin be present, digestion of the albumin will occur. If no free hydrochloric acid be present in the contents, the same test is applied, the contents having first been brought to the proper acidity by the addition of hydrochloric acid.

These determinations performed in this way also enable us to form some rough quantitative estimation of the pepsin present. In the normal contents, 50 milligrammes of egg is entirely dissolved in 25 c.c. of contents within three hours. The acidity being normal then, either naturally or by addition of acid, a duration of the dissolution of the egg over three hours indicates a diminution in pepsin.[54]

A more definite quantitative estimation, suited to practical work, may be made as follows:[55] A 1 per cent. solution of albumin (dry) containing 4 per cent. free hydrochloric acid is made up. This is divided into two portions of 10 c.c. each. To one portion 5 c.c. of water are added, to the other 5 c.c. of the filtrate of the gastric contents to be tested. Both mixtures are then placed at a temperature of 40° C. for one hour. The amount of albumin in each solution is then tested by means of an Esbach albuminometer, and from the comparative results the per cent. strength of the contents estimated. Thus, if the first solution shows 6 per cent. albumin and the second 3 per cent., the contents are said to have a 50 per cent. strength pepsin. The normal contents give from 80 per cent. to 90 per cent. by this test.

Rennin, the milk-curdling ferment of the stomach, is formed from its zymogen, which exists in the cells of the gastric mucous membrane, by the action of the secreted acid. A certain amount of rennin can, however, be obtained by the addition of water to the mucous membrane, even where no free HCl is present in the stomach. Rennin is active in acid, neutral or even feebly alkaline solutions.[56]

The normal gastric contents contain both rennin and its zymogen.[57]

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[54] Hammerschlag: Naturforscher-Versammlung, 1894, und Archiv d. Verdauungskrankheiten, Bd. II, H. 1.

[55] Jaworski: *Zeitschr. klin. Med.*, Bd. XI, s. 275.

[56] Heintz: *Jour. f. prakt. Chemie*, Neur. Folg., Vol. VI, p. 374.

[57] Hammarsten: Mohr's Jahrsbericht, Vol. II, 118, Vol. IV, 135, Vol. VII, 158.

The test for rennin is as follows: 10 c.c. of the filtrate of the gastric contents are neutralized with decinormal solution of NaOH. To this 10 c.c. of neutral milk are added, and the mixture tested at 38° C. If rennet be present, casein will form in ten to fifteen minutes.[58]

The test for the zymogen is as follows, in the absence of the ferment: To 10 c.c. of the filtrate, made slightly alkaline, add 2 c.c. of a 1 per cent. solution of calcium chloride; then 10 c.c. of milk, and heat at 38° C. If rennet is present casein will form. It is rare to find a condition in which rennet or the rennet zymogen is wholly absent, but a marked diminution of these substances is characteristic of certain morbid conditions.

In some cases, therefore, aid may be derived from a quantitative estimation of these substances.

The quantitative estimations for rennet and the zymogen are as follows: Part of the gastric filtrate is exactly neutralized, and portions of this diluted to different dilutions, as one-tenth, one-fifteenth, one-twentieth. Five c.c. of each dilution are placed with 5 c.c. of neutral milk at 38° C., and the dilution at which the ferment ceases to be active ascertained. By comparing the result with normal results, any diminution and the amount of it can be observed. For the zymogen a portion of the filtrate is made alkaline; different dilutions made, one-tenth to $\frac{1}{16}$; 5 c.c. of dilution placed with 1 c.c. $CaCl_2$, *plus* 5 c.c. of milk; and the dilution where action ceases recorded.

Full tables of the normal amounts of the rennin and its zymogen in the normal conditions can be found in Friedenwald's article on the subject.[59]

(*To be continued.*)

RECENT LITERATURE RELATING TO PHARMACY.

EFFECTS OF MINERAL SALTS ON THE DEVELOPMENT OF PLANTS.

M. C. Dassonville has made a series of experiments on the effect of solutions of various mineral salts, especially of Knopp's solution, on the growth of cereal crops—wheat, rye, oat and maize—as compared with that of pure water. The general result arrived at is that

[58] Boas: Magenkrankheiten. *Loc. cit.*

[59] Friedenwald: *Medical News*, June 22, 1895.

with distilled water the tissues are less fully developed, but more strongly lignified. Thus, in a saline solution, both the roots and the stem become longer; the size both of the vessels and of the air cavities is increased, while the walls of the vessels are less strongly lignified.—*Comptes rendus*, cxxiv, p. 1467, through *Pharmaceutical Journal*, November 27, 1897.

IRRITATION CAUSED BY WINTERGREEN OIL.

In the course of treating cases of rheumatism by means of the absorption of methyl salicylate, Vidal noticed that some samples of oil of wintergreen caused irritation of the skin, in some cases even causing an eruption. Investigation showed that irritation invariably followed the use of the natural oil of wintergreen, and that when pure synthetic methyl salicylate was employed simultaneously on the same subject no discomfort whatever was felt. It is evident, therefore, that the natural oil contains some irritant body, and that the pure synthetic oil is to be preferred for application to the skin.—*Nouv. Rem.*, xiii, 615, through *Pharmaceutical Journal*, November 27, 1897.

DOUBLE RICE.

In the *Proceedings of the Asiatic Society of Bengal*, for April, 1896, Dr. D. Prain describes and figures what is known in India as double rice. In all cases the phenomenon was found to be due to an increase in the number of ovaries, the other parts of the flower being invariably of the normal number. In the gynæceum of over 150 flowers examined, not one was found with fewer than four ovaries, all apparently perfect, the usual number being five. A few flowers were found to have six, and one or two had seven ovaries. When five, six or seven ovaries were present, sometimes only three, but usually four or five, appeared to be perfect. The ovaries may be one-, two-, or three-styled. Usually only two ovaries develop into grain, sometimes three, and their shape is modified accordingly.—*Kew Bulletin*, April, 1897.

SORGHUM SUGAR.

The sugar sorghum or broom-corn (Andropogon Sorghum, Brot., var. Saccharatus, Koern.), is a grass largely cultivated in Northern India, China and Japan, as well as in the United States. It is, however, native of none of these countries, and its original home is ob-

scure, but is probably tropical Africa. For many years past a strenuous effort has been made in North America to utilize the sugar sorghum as a source of sugar in a zone north of that in which the sugar-cane is grown. The result has not, however, been very successful, as the sugar can only be obtained for the most part in an uncrystallizable form. Syrup is, however, a large article of consumption in the United States, and this alone affords the industry a chance of success.—*Kew Bulletin*, April, 1897.

ON A NEW CLASS OF OXIDIZING SUBSTANCES—THE PERCARBONATES.

The discovery of this series of compounds was recently announced by MM. Constan and A. von Haussen. These authors report that on electrolyzing a saturated solution of potassium carbonate, and gradually lowering the temperature, the disengagement of oxygen at the anode ceases altogether at—10° C. And that instead of the crystalline bicarbonate being formed, as is the case when an alkaline carbonate is subjected to electrolytic action under ordinary conditions, the result is a bluish amorphous powder, having the formula $K_2C_2O_6$. This is percarbonate of potassium, but it is not formed in dilute solutions. Owing to its hygrometric character, the powder should be quickly thrown on a filter, and dried over phosphoric anhydride. It is decomposed by gentle heating, into the normal carbonate, carbon dioxide and oxygen. In the presence of oxidizable substances it acts as an oxidizing agent; but it may act as a reducing agent. From these properties the authors conclude that this compound is a neutral carbonate of peroxide of potassium. Like the higher alkaline oxides and the alkaline earths, it produces hydrogen peroxide in the presence of acids.—*Zeitschrift für Electrochemie*, through *Chemical News*, October 1, 1897.

FRUIT INDUSTRIES IN JAMAICA.

Kew Bulletin for July, 1897, contains some interesting statements in regard to the exports of Jamaica. The total value of these for 1895–96 was £1,873,105, and nearly two-thirds of this amount was for exports to the United States. The trade between Jamaica and the United States is chiefly in fruits and other fresh tropical produce, and these are conveyed by a fleet of steamers specially fitted for the purpose. The principal fruit cultivated is the banana, and of this 4,220,796 bunches, having a value of £316,560, were exported

in 1895-96. During the same period, owing to the recent destruction of the orange trees in Florida, 97,925,398 oranges, valued at £169,794, were also exported. Some other valuable products, including logwood, coffee, ginger, allspice, etc., are enumerated. In addition, the exports of the following fruits and fruit products appear to be increasing from year to year: Cocoanuts, grape fruit, shaddocks, Tangerine oranges, limes and lime-juice, pineapples, kola nuts and tamarinds. The total value of the fruit exported from Jamaica at the present time amounts to £537,601. The fruit exported from Jamaica as the Tangerine orange is for the most part the large-fruited Mandarin orange, native of China. Both the leaves and the loose rind of this fruit possess a characteristic odor unlike that of any other of the orange tribe. The true Tangerine orange is smaller than the Mandarin, with an agreeable but slightly perfumed flavor.

BROOM ROOT.

An account of broom root, or Mexican whisk, obtained from one or more species of grasses belonging to the genus Epicampes, was given in the *Kew Bulletin* for December, 1887 (p. 9). The roots in the condition in which they are exported are known as "Raiz de Zacaton." During some years very little has been exported, but latterly increased interest has been taken in them as a cheap substitute for the well-known Venetian whisk, derived from the roots of Chrysopogon Gryllus. The most recent information respecting broom-root is contained in the following "Report for the year 1895 on the Trade of Mexico" (F. O., 1896, Annual Series, No. 1827):

"From the roots of a coarse, tufty grass, known as 'Zacaton,' which is found growing wild all over the highlands of Mexico, a fibre is extracted called 'Raiz de Zacaton,' which has found a market abroad for the manufacture of certain kinds of brushes and whisks. It is collected by hand, and is subjected to very little treatment before being baled, beyond being soaked in water and bleached in the sun. The principal market for this fibre is Hamburg, but the United States and France both take a certain amount. It has never obtained a foothold in the English market. The export in 1895 was valued at 67,599*l*. The price, according to the New York quotations, ranged in the year under question from 6c. to 14c. per pound, according to quality."—*Kew Bulletin*, April, 1897.

WINE PRODUCTION IN FRANCE.

The following information concerning the above subject is taken from *Kew Bulletin*, in its issue of May and June, 1897:

The annual wine production of France, which, during the twenty-five years preceding the year 1879, amounted on the average to 1,000,000,000 gallons, a quantity sufficing both for the wants of home consumption in this country and for those of the export trade to foreign countries (about 65,000,000 to 75,000,000 gallons per annum), has since that time (in consequence of the ravages of the phylloxera and other vine diseases, as well as of unfavorable atmospheric influences during many years) declined to an average annual yield of about 725,000,000 gallons, a falling off, therefore, of about 275,000,000 gallons per annum.

In order to meet this deficiency, France, as is well known, has been obliged to import largely foreign (more especially Spanish, Italian, Portuguese and Dalmatian) wines, which are to some extent sold in their original state, but the far larger proportion are used for blending with the light French wines of the commonest class. These blended Franco-foreign wines find a ready market, as they are by no means always unpalatable, and often very fair (nor are they unwholesome, as they are, after all, mixtures of the pure juice of foreign and French grapes); they are served as so-called "vin ordinaire" in a large number of even the better class of hotels and restaurants all over France. On the other hand, however, the dearth of the cheapest kind of French wines, which in former times were abundant enough to be obtained even by the most modest purse, has given rise to a great development of the manufacture of artificial wines (made from raisins and other grape substitutes), and these find a ready market, especially amongst those poorest classes of the population who look more to the low price than to the quality of the liquor, of which they are accustomed to drink a large quantum. That in the Gironde, for instance, this daily quantum of wine is considerable amongst both the poorer and wealthier inhabitants is evident from the fact that the average annual consumption of wine per head of the population in this department amounts to 32·34 gallons.

EDITORIAL.

MORE PURE FOOD INJUSTICE.

Pure food legislation is having a hard struggle in Monroe County, this State. It was from that locality that we reported, last month, the failure to convict in an acknowledged case of adulterated mustard, because the jury could not decide whether it was a food or poison. This month it is reported that two firms were indicted for selling impure vinegar. The indictments were quashed because the defendants were arrested prior to the Act of Assembly passed in 1897. The judge concluded his opinion as follows: "It is impossible for us sustain this indictment. It cannot be sustained under the Act of 1897, because the Act was not in existence when the offence charged was committed. Nor can it be sustained under the Acts of 1891 and 1895, because they were repealed without any saving clause." The question of guilt does not appear to have entered into these cases; it is rather a question of technicalities. Justice was so tardy that a new law was created which enabled the defendants to escape. Such defects in the administration of the law make dealers defiant, and are a menace to the public. When no laws are in existence the people learn to take some precautions for themselves. It is said that the Pure Food Commission has lost every case tried in Monroe County. We are not prepared to say that no laws should be passed for the prevention of food and drug adulteration, but we do say that conviction under these laws has heretofore been very difficult. As a rule, there has been no question about the guilt of the parties arrested, but some legal loophole has usually been found. A number of cases have occurred where the defendant has escaped because the law did not state which edition of the U. S. Pharmacopœia should be used as a standard. That defect, however, has been remedied in many of the laws.

DESTRUCTION TO COUNTERACT OVERPRODUCTION.

Anent this subject, which has received some attention in the two preceding numbers of this JOURNAL, Professor Lloyd furnishes the following from Valmont-Bomare, Dictionnaire, Vol. IX, Lyon, 1800, Muscade, p. 323: Speaking of the storehouses of the Dutch for precious spices, the author says: "The Dutch do not distribute their recent harvests, but always their oldest; in 1760 they sold the stock of 1744. It is commonly believed in France and other countries that when the Dutch have too much of cloves, or nutmegs, etc., in their storehouses, they throw the surplus into the sea. But it is not in this manner that they get rid of these spices; they *burn* them. On the 10th of June, 1760, I saw a fire in Amsterdam, near the Admiralty, that was fed by goods estimated at 8,000,000 of French money; the following day another lot, amounting to the same value, was to be burned. The spectators' feet bathed in the essential oil of these substances, but nobody was permitted to gather any of it, nor to take any of the spices that were in the fire. I was told that some years ago, in the same place, a poor individual who, in a similar fire, picked up a few nutmegs that had dropped and rolled away from the furnace, was seized bodily, condemned to be hanged, and executed on the spot."

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

AN EPITOME OF THE HISTORY OF MEDICINE. By Roswell Park, A.M., M.D. The F. A. Davis Company, Philadelphia, New York and Chicago. 1897.

The author believes that the history of medicine has been sadly neglected in our medical schools, and that much of "what not to do" might be learned by a more careful study of this subject. "The history of medicine," he says, "is really a history of human error and human discovery. During the past 2,000 years it is hard to say which has prevailed."

After a preliminary history of the very earliest times, the subject is divided according to the arrangement of Renouard as follows:

AGE OF FOUNDATION.—(1) The *Primitive Period*, or that of *Instinct*, beginning with myth, and ending with the destruction of Troy, 1184 years before Christ.

(2) The *Sacred or Mystic Period*, ending with the dispersion of the Pythagorean Society, 500 years before Christ.

(3) The *Philosophic Period*, terminating with the foundation of the Alexandrian library, 320 years before Christ.

(4) The *Anatomic Period*, ending with the death of Galen, about A. D. 200.

THE SECOND AGE, OR THAT OF TRANSITION, is divided into a fifth, or *Greek Period*, ending at the burning of the Alexandrian library, A.D. 640, and a sixth, *Arabic Period*, ending with the revival of letters, A. D. 1400.

THE THIRD AGE, OR THAT OF RENOVATION, includes the seventh or *Erudite Period*, comprising the fifteenth and sixteenth centuries; and eighth, or *Reform Period*, comprising the seventeenth, eighteenth and nineteenth centuries.

With such a groundwork, a very readable book has been produced. A final chapter of some ten pages is devoted to "An Epitome of the History of Dentistry."

The text is enlivened and the whole book much improved by fifty-six excellent figures, mostly of prominent physicians, beginning with Esculapius, and ending with Lord Lister.

The book is written in excellent style, and tends to hold the attention of the reader throughout. It contains a large amount of matter admirably condensed, and we only notice one omission, namely, pharmacy; no reference whatever is made to this important part of medicine, except in the quoted title of some book or paper. Will any one admit that the history of medicine in any age can be complete without some reference to pharmacy?

INTRODUCTION TO ELECTROCHEMICAL EXPERIMENTS. By Dr. Felix Oettel. Translated by Edgar F. Smith. P. Blakiston, Son & Co., Philadelphia. 1897.

The purpose of this volume is to furnish technical chemists and all others interested in the applications of electricity to chemical manufacture with a concise guide, containing in a compact form all that is essential for the comprehension and solution of problems arising in this comparatively new field of chemical investigation. The subject is considered under the following headings: (1) Source, Measurement and Regulation of Current; (2) Arrangement of Experiments; (3) Phenomena Observed in Electrolysis; (4) Preliminary Experiments of an Electrolytic Process; (5) Calculation of Necessary Power, Choice of Dynamo; (6) Practical Part; (7) Tables.

Much practical information is contained in the 144 pages, and the whole is made more attractive and available by the 26 illustrations.

PRACTICAL EXERCISES IN ELECTROCHEMISTRY. By Dr. Felix Oettel. Translated by Edgar F. Smith. P. Blakiston, Son & Co., Philadelphia. 1897.

Much is heard in these days about the study of electrochemistry, but the student is at a loss to know where to make a beginning. This book of 92 pages supplies one with the necessary technique of the subject. By working through this book the student would have his ideas enlarged similarly to one who has taken a practical course in chemistry. Many of the experiments are types of definite processes, which are not only instructive, but suggestive. Much credit is due Dr. Smith for rendering this and the foregoing work available to English-speaking students.

RECUEIL DES LOIS DE LA BIOLOGIE GÉNÉRALE. Par A. L. Herrera, Ancien Président de la Société Alzate. Lauréat de l'Institut Smithsonien. Mexico. 1897.

This is a compilation of what may be termed laws in the science of biology, which are so well established as to be used as the basis for theories, of which there are a number in existence. The great laws are those concerning time, unity, elementary life, particular ends, differentiation, variability, adaptation, selection, distribution, struggle for existence and evolution. These are subdivided, and the law governing each subdivision is briefly stated in a way to make the whole a valuable reference book for biologists. It is evidently the result of much investigation by the author, as well as a close study of the results of others.

OBSERVATIONS ON RECENT CASES OF MUSHROOM POISONING IN THE DISTRICT OF COLUMBIA. By Frederick V. Coville. Department of Agriculture, Division of Botany. Circular No. 13.

With the aid of photographic reproductions and a clear description, the author is able to give much information that will assist in distinguishing the edible from the poisonous mushrooms. Very sensible advice is given to the novice, who is too apt to rely on printed descriptions, namely, to get his authority for the identity and qualities of each one he adds to his list from some person having unquestioned expert knowledge of the subject.

NORTH AMERICAN LEMNACEÆ. By Charles Henry Thompson. Printed in advance, from the Ninth Annual Report of the Missouri Botanical Garden.

The natural order Lemnaceæ has been especially studied by such authorities as Schleiden, Austin, Hegelmaier, Engelmann and Torrey. The author has sought to bring together the results of these investigations, and include his own researches of the past two years. The outcome is a valuable revision of the American species in this order.

THE PHYLOGENY AND TAXONOMY OF ANGIOSPERMS. By Charles E. Bessey, Ph.D. Address of the retiring president, delivered before the Botanical Society of America, at its third annual meeting, Toronto, Ontario, August 17, 1897.

With the aid of diagrams this rather technical subject has been made clear and popular in character.

AN UNUSUAL PHYTO-BENZOAR. By William Trelease. Transactions of the Academy of Science, St. Louis, Mo., Vol. VII, No. 18.

This is the record of two specimens from Mexico, one measuring 3½ inches in diameter and weighing 7½ ounces; the other one half of a similar ball about 4 inches in diameter and weighing 4 ounces. Sixteen of these balls were taken from the stomach of a bull. They were found to be composed of the agglomerated fibres of several species of Opuntia. Photographic reproductions accompany the description.

BEITRÄGE ZUR CHEMIE DER SOG. GERBSÄUREN (GLYKOTANNOIDE). Von Hermann Kunz-Krause, Lausanne. Reprint from *Chemiker Zeitung*, **21**, No. 90.

UEBER DIE SPONTANE VERÄNDERUNG DER PFLANZENSTOFFE, ÜBER DIALYSIRTE PFLANZEN EXTRACTE (DIALYSATA) UND ÜBER DIE CAPILLARANALYSE IM DIENSTE DER PHARMACIE. Von Hermann Kunz-Krause, Lausanne. Reprint from *Chemiker Zeitung*, **21**, No. 90.

INFLUENCE DE LA SÉCHERESSE DE 1893 SUR LA VÉGÉTATION FORESTIÈRE. Par E. Henry, Nancy. A communication made to the School of Forestry, February 15, 1897.

CEPHAELIS IPECACUANHA. By John Uri Lloyd. Reprint from *Western Druggist*, August, 1897.

This is a complete account of this important drug, beginning with its botanical origin and carried through its interesting history, cultivation, collection, chemical constituents, adulterations, physiological properties and bibliography.

VERATRUM VIRIDE. By John Uri Lloyd. Reprint from *Western Druggist*, October, 1897.

Like the preceding, this is an interesting study of an important drug. The section on the chemical composition is especially complete, and, although the author has summed up a mass of literature on the subject, he suggests that an additional investigation should be made, in order to more clearly define the chemical characters.

CHLORALAMID. Published by Lehn & Fink, New York. Sixth edition.

The various investigations which have been made on the value of this new hypnotic are given, supplemented by the opinions of a large number of physicians.

PROCEEDINGS OF THE FIFTEENTH ANNUAL MEETING OF THE MICHIGAN PHARMACEUTICAL ASSOCIATION, held at Grand Ledge, August, 1897.

The Michigan Pharmacy Law is included in this report. It also contains the several original papers that were read at the meeting.

PROCEEDINGS OF THE MINNESOTA PHARMACEUTICAL ASSOCIATION AT THE THIRTEENTH ANNUAL MEETING, held at Lake Minnetonka, August, 1897.

PROCEEDINGS OF THE SIXTEENTH ANNUAL MEETING OF THE VIRGINIA PHARMACEUTICAL ASSOCIATION, held at Charlotteville, July, 1897.

PROCEEDINGS OF THE PENNSYLVANIA PHARMACEUTICAL ASSOCIATION, AT ITS TWENTIETH ANNUAL MEETING, held at Delaware Water Gap, June, 1897.

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, December 21, 1897.

The regular Pharmaceutical Meeting was held at 3 P.M., with Dr. C. B. Lowe in the chair.

The minutes of the previous meeting were allowed to stand as published. The next in order was the presentation and exhibition of specimens. Among these were two flowering plants of Scotch heather, belonging to Mr. Howard B. French. It was thought that these would be of interest on account of the sentiment attaching to this plant in Scotland. Dr. A. W. Miller said that a species of heather, Calluna vulgaris, grows at Egg Harbor, N. J., where it attains a height of 2 or 3 feet, the conditions seeming to favor its growth in that locality. Samples of metallic aluminum, nickel and cobalt, and one of pyrolusite (from Reno, Nev.) were donated by Mr. Charles Bullock. The Registrar, Mr. T. S. Wiegand, presented specimens of metallic zinc, antimony, copper and manganese. Samples of several kinds of material used for water filtration were received from Dr. F. E. Stewart, and a sample of false or Bombay mace, which is used as an adulterant, was sent by Mr. Richard M. Shoemaker.

On motion, a vote of thanks was tendered the donors of specimens.

A paper on "Liquid Benzoin for Benzoinating Lard," was read by J. W. England, in behalf of the author, Richard M. Shoemaker.

Samples of gum benzoin, the liquid benzoin and benzoinated lard, made by the use of the latter, accompanied the paper.

Professor Trimble spoke of the particular value of this paper from the standpoint of its utility. He attributed the preservative action of benzoin mostly to the benzoic acid, which, he said, appeared to have a preservative effect on vegetable and animal matter, while boric acid is most largely used for preserving animal substances. Others were of the opinion that the preservative action is due to the volatile constituents or to the resin.

Upon request, Dr. A. W. Miller presented quite an interesting description of the plants conspicuous on our streets previous to Christmas, in a paper having the title: "Botany on Market Street." These plants are mostly evergreens, some of them being brought from the Southern States, and, in order to make the description instructive as well as pleasing, the scientific and common names were both given. An occasional introduction of poetical selections, inspired either by the customs of this season of the year or by some particular plant, harmonized well with the subject.

"A Contribution to the Knowledge of the Gum from the Oil Tree" was the subject of a highly meritorious paper read by Charles W. Dirmitt.

Professor Trimble remarked upon the interest which attaches to this so-called gum, on account of the relation which it appears to sustain to the higher fatty acids. He called attention to samples of the gum, and of the residue left after distillation.

A paper entitled "On the Use of Acetone as a Solvent in Preparing the Official Resins," was presented by Edward T. Hahn. The author stated that acetone seemed to be specially adapted as a solvent for resinous materials, and that when applied to the drugs for the preparation of the above substances it readily penetrated them, and as a result percolation was more rapid than when alcohol was employed. Samples of resins prepared both with alcohol and with acetone were very similar in appearance.

Mr. James T. Shinn remarked upon the solubility of gun-cotton in acetone.

Dr. Lowe said that hardly any of the jalap found in the market of late years contained the amount of resin required by the Pharmacopœia, although he believed there was some improvement in this respect during the last two or three years.

With reference to the use of acetone as a solvent, Professor Trimble said that the lacquer which is used for brasswork is a solution of gun-cotton in amyl acetate, together with acetone, petroleum ether or wood alcohol.

Dr. Miller made a somewhat novel statement in reference to oil of bay. His attention had recently been directed to two grades of this oil, the one, the better quality, quoted at a certain price, and the other marked U. S. P., and having a lower price. Upon inquiry as to the cause of this state of affairs, it was found that eugenol had been added to the natural product to raise the specific gravity, and thus make the oil conform with pharmacopœial requirements.

"An Examination of Some Commercial Powdered Extracts of Licorice" was the subject of a paper read by Calvin O. Kinzey.

In comparing the results obtained by the author, the American extracts were found to be of better quality than either the Spanish or Greek extracts.

Mr. Alfred Mellor said that tobacco manufacturers are the largest consumers of extract of licorice, and that they use the following method for estimating the glycyrrhizin: Ten grammes of the extract are dissolved in 100 c.c. of water; 200 c.c. of alcohol are added, and the mixture allowed to stand twelve hours or over night. This precipitates insoluble matter, which is separated by filtration. The glycyrrhizin is then precipitated by adding sulphuric acid to the filtrate.

There being no further business, on motion, the meeting adjourned.

T. S. WIEGAND,
Registrar.

NOTES AND NEWS.

The *Seychelles vanilla* crop of 1896 was the largest that has ever been grown in the colony, amounting to 63,000 pounds, valued at about Rs. 936,000. The cultivation of vanilla in the colony dates back about twenty years, and is only now beginning to be thoroughly understood. The comparatively large output has given a fresh impetus to its cultivation, and a very large quantity has been planted. The Mexican system of allowing the vines to grow under trees, nearly wild, is at present in vogue, and is said to be a decided improvement on the old system of training the vines on artificial supports. The production of vanilla costs the planter Rs. 3 per pound, and the prices vary from Rs. 8 to Rs. 16 per pound. The average yield is about 200 pounds an acre, and land can be bought at from Rs. 100 to Rs. 200 the acre. Administrator Stewart regrets that Seychelles is almost a *terra incognita*, because he believes the colony offers advantages not to be met with elsewhere for the investment of small capital of, say, about £1,000.—*Pharmaceutical Journal*, November 27, 1897.

CLASSES

—OF THE—

PHILADELPHIA COLLEGE OF PHARMACY,

SEVENTY-SEVENTH ANNUAL SESSION, 1897-1898.

FIRST YEAR CLASS LIST.

Name.	*Place.*	*State.*	*Preceptor.*
Adam, Geo. Freshell,	Richmond,	Va.	Geo. Freshell.
Albright, Allen Enos,	Allentown,	Pa.	C. L. Shoemaker.
Allison, James Elmer,	Chambersburg,	Pa.	Cressler & Keefer.
Andrews, Wm. Hall,	Woodstown,	N. J.	Geo. W. Andrews.
Apple, Chas. Andrew,	Stroudsburg,	Pa.	F. M. Apple.
Austin, Chas. Howard,	Williamstown,	N. J.	Theodore Campbell.
Baker, Maineard Lesher,	Cowan,	Pa	W. D. Heiser.
Barnes, Chas. Wesley,	Thomasville,	Ga.	Chas. S. Bondurant.
Beardsley, Edward John,	Hartford,	Conn.	Chas. A. Rapelje.
Beatty, Arthur Wm.,	St. Louis,	Mo.	H. C Blair.
Bernhard, Hugo A.,	Canal Dover,	O.	J. W. Pfeiffer.
Bethel, John Percy,	Philadelphia,	Pa.	B. N. Bethel, M.D.
Bishop, Wm. H. Pancoast,	Carversville,	Pa.	J. H. Bishop, M.D.
Blew, Joseph Oscar,	Bridgeton,	N. J.	C. F. Dare & Son.
Borrowes, Geo. Henry,	Philadelphia,	Pa.	H. C. Blair.
Bosler, Harry Ellis,	Olean,	N. Y.	J. C. Welch.
Bowers, Howard Levin,	Easton,	Pa.	A. Lincoln Serfass.
Branin, Manlif Lewis,	Millville,	N. J.	Chas. B. McLoughlin.
Brennan, Ed. Vincent,	Plymouth,	Pa.	L. W. Rehbein.
Brookes, Jennie,	Waelder,	Tex.	
Brooks, Walter,	Quarryville,	Pa.	T. M. Rohrer, M.D.
Buckman, Wm. Watson,	Newtown,	Pa.	M. M. Buss.
Burchfield, Wm. Clinton,	Ashland,	Pa.	R. J. Williams.
Burr, Agnes Haworth,	Earlington,	Ky.	
Callahan, Samuel Irving,	Pennsville,	N. J.	W. H. Dunn.
Carey, Harris May,	Wyoming,	Del.	N. O. Harris.
Cartwright, Sanford Warren,	Fresno,	Cal.	
Cashman, Wylie Palmer,	Chambersburg,	Pa.	Cressler & Keefer.
Casperson, Henry Lyle,	Clayton,	Del.	T. C. Taylor & Co.
Connell, Francis Joseph,	Pottstown,	Pa.	Chas. A. Eckels.
Cook, Ernest Fullerton,	Waynesboro,	Pa.	Mentzer & Clugstan.
Corson, Thomas Clark,	Philadelphia,	Pa.	W. J. Scott.
Craig, Henry Douglas,	Mauch Chunk,	Pa.	J. W. Smith.
De Crow, Reaves Warren,	Utica,	O.	J. W Collins.
Dentler, Roy W.,	Turbotville,	Pa.	Frank W. Ely.
Desch, Edward Allen,	Fogelsville,	Pa.	C. J. Biddle.
Diehl, Andrew Thompson,	Carlisle,	Pa.	B. F. Emerick.
Dietz, Harry Edgar,	Lock Haven,	Pa.	George W. Mason.
Doake, Robert Stewart,	Philadelphia,	Pa.	Theodore Campbell.
Dobson, Leonard Stanley,	Philadelphia,	Pa.	C. L. Dobson.
Dooley, John Joseph,	Plymouth,	Pa.	George J. Durbin.
Dorman, Harry Milton,	Phœnixville,	Pa.	Wm. A Dorman.

Name.	*Place.*	*State.*	*Preceptor.*
Doughty, John Thompson,	Millville,	N. J.	E. M. Boring.
Doyle, Francis J.,	Salem,	N. J.	Edwin A. Trist, M.D.
Duffy, Thomas Anthony,	Carbondale,	Pa.	B. A. Kelly.
Early, Eugene,	Harrisburg,	Pa.	Forney & Knouse.
Eddy, Eugene Henry,	Lorain,	O.	J. H. Folkens.
Edwards, Manly Bruce,	Bloomsburg,	Pa.	Geo. P. Ringer.
Eldridge, Wm. Arthur,	Salem,	N. J.	Frank Luerssen.
Elwell, Ralston Fithian,	Bridgeton,	N. J.	C. F. Dare & Son.
Eshleman, Ellis Good,	Faggs Manor,	Pa.	W. H. Laubach, Jr.
Fabian, Asa,	Ottsville,	Pa.	R. H. Lackey.
Faunce, George Castor,	Philadelphia,	Pa.	T. W. Hargreaves.
Fenner, Harvey Albert,	So. Bethlehem,	Pa.	Campbell & Bro.
Fiet, John Jacob,	Philadelphia,	Pa.	Harvey J. Fiet, M.D.
Fisher, John Anthony,	Tremont,	Pa.	J. H. Schultz.
Foster, William Newell,	Philadelphia.	Pa.	Geo. F. Ralston, M.D.
Fox, Harry Terry,	Zanesville,	O.	Wm. M. Chappelear.
Franke, Louis,	Johnstown,	Pa.	C. G. Campbell.
Fretz, William,	Sabetha,	Kans.	R. T. Blackwood.
Fulton, Chauncey Curren,	York,	Pa.	W. L. Smyser.
Furst, Edgar Shuman,	Cedar Springs,	Pa.	H. C. Blair.
Garritt, Henry James,	Huron,	O.	J. M. Garritt.
Gibble, John Harry,	Manheim,	Pa.	Elmer E. Gibble, M.D.
Goodyear, Harry Jacob,	Cornwall,	Pa.	J. L. Lemberger.
Graff, George Wells,	Philadelphia,	Pa.	John B. Reynolds.
Greenberg, Jacob,	Novomirgorod,	Russia.	M. Peissakovitch.
Greenblatt, Max,	Philadelphia,	Pa.	Pinkas Rovno.
Griest, Joseph Taylor,	Peoria,	Ill.	W. M. Benton.
Guest, Wilbert Hillman,	Woodstown,	N. J.	Harry Guest.
Hampson, William Harvey,	Philadelphia,	Pa.	Frank F. Drueding.
Harmony, Edmund Franklin,	Allentown,	Pa.	Chas. S. Shoemaker.
Harrison, Charles,	East Liverpool,	O.	Chas. F. Larkins.
Hart, Lawrence Sylvester,	Philadelphia,	Pa.	
Hauber, Christian Henry,	Philadelphia,	Pa.	F. W. Haussmann.
Heinze, George Elmer,	Ashland,	Pa.	August Schoenenberger.
Hemberger, Paul Edward,	Dayton,	O.	John N. Prass.
Hilbish, John Henry,	Fredericksburg,	Pa.	J. C. Greisemer.
Hillebrand, William Gustav,	Philadelphia,	Pa.	Wm. N. Seary.
Hires, Lewis Moore,	Bridgeton,	N. J.	Reeve & Fithian.
Holloway, Paul Fendenberg,	Harrisburg,	Pa.	Holloway & Co.
Holmes, Frederick Cost,	Dover,	Del.	Andrew Blair & Co.
Housholder, Charles Edward,	Harrisburg,	Pa.	Frank S. Keet.
Huffer, Walter Craig,	Muncie,	Ind.	H. B. Morse.
Hughes, Harry Wilbert,	Millville,	N. J.	H. A. Volte.
Hunsinger, Merton Acto,	Forkston,	Pa.	
Irby, Moreland Russell,	Ashland,	Va.	N. Knight.
Jackson, Edward Farrel,	Wyoming,	Del.	J. B. Cook.
Jaeger, William Charles,	Philadelphia,	Pa.	Chas. H. Bohn.
Jelliff, Glenn Eli,	Mansfield,	Pa.	A. H. Elliott.
Kachline, Paul Hartzell,	Easton,	Pa.	John A. Weaver.
Kazanjian, Rupen Hagop,	Adana,	Armenia.	R. Hambleton, M.D.
Kelly, Edward Jaochin,	Philadelphia,	Pa.	G. G. Howard.
Kiefer, William Frederick,	Philadelphia,	Pa.	H. G. Comp & Co.
Kilgus, Harry Edward,	Renovo,	Pa.	Est. of M. L. Clay.
King, Lloyd Stanley,	Dayton,	O.	Wm. P. Graybill.
Landauer, Oscar,	Philadelphia,	Pa.	Theodore Sprissler, M.D.
Landis, Roger Levan,	Union Deposit,	Pa.	G. L. Carnan.
Lawn, John Thomas,	Philadelphia,	Pa.	F. W. E. Stedem.
Lawrence, John Whitaker,	Johnstown,	Pa.	C. F. Kirkendall.
Lee, Walter Estell,	Philadelphia,	Pa.	Wm. E. Lee.
Lehman, Samuel William,	Shippensburg,	Pa.	J. C. Altick & Co.

Name.	*Place.*	*State.*	*Preceptor.*
Lilly, Herbert George,	Chapman Quarries,	Pa.	John Horning.
Lintner, Edwin Windolph,	Millersville,	Pa.	
Lum, William Alvin,	Northeast,	Md.	F. E. Harrison.
McCaffry, Ward Bolon,	Berkeley Springs,	W. Va.	Thos. E. Hodgson.
McClure, Charles Nevin,	York,	Pa.	Alfred F. G. Hodnett.
Mackey, Joseph Quarll,	Avondale,	Pa.	Lawson C. Funk.
Magee, Michael Vincent,	Conshohocken,	Pa.	Thos. F. McCoy.
Maier, Frank Joseph,	Woodbury,	N. J.	Alfred S. Marshall.
Malloy, Marvin Edward,	Indianapolis,	Ind.	J. Stephen Malloy, M.D.
Manges, Willis Fastnecht,	Felton,	Pa.	G. W. Shoemaker & Co.
Marsland, John Williams,	Chester,	Conn.	Chas. Dickinson.
Mayes, William Rush,	Coleman,	Tex.	Coulson & Chadwell.
Meredith, Harry Lionel,	Hagerstown,	Md.	D. C. Aughinbaugh & Son.
Merz, Alfred William,	Württemberg,	Germany.	E. W. Herrmann.
Meuser, Charles John,	Easton,	Pa.	Chas. Bachman.
Michael, George Albert,	Lebanon,	Pa.	Chas. E. Boyer.
Miles, James Barzillai, Jr.,	Helena,	Ark.	
Moeller, Carl Frederick,	Harrisburg,	Pa.	Dr. Hickman.
Morgan, Lulu Annette,	Scranton,	Pa.	
Morris, William Torrey, 2d,	Penn Yan,	N. Y.	T. F. Wheeler.
O'Donnell, Daniel Charles,	Shenandoah,	Pa.	P. W. Houck.
Ohliger, Willard,	Wooster,	O.	Zimmerman & Co.
Peiffer, Arthur,	Philadelphia,	Pa.	Steltz & Co.
Pile, Wilson Hunt,	Philadelphia,	Pa.	Gustavus Pile.
Popp, Andrew Ralph,	Reading,	Pa.	N. E. Cozen.
Pursel, Robert Clayton,	Bloomsburg,	Pa.	Moyer Bros.
Quinn, Francis Dennis,	Johnsonburg,	Pa.	
Rectenwald, Daniel Louis,	Pittsburg,	Pa.	Nelson Fry.
Reinhart, John Quigley,	Sheperdstown,	W. Va.	H. B. Morse.
Rhoad, Irwin Bieber.	Kutztown,	Pa.	Funk & Groff.
Richards, Daniel Arthur,	South Easton,	Pa.	A. J. Odenwelder.
Ricketts, Clarence Emerson,	Kane,	Pa.	E. H. Watkins.
Russell, Walter Harold,	Coatesville,	Pa.	Geo. W. Davy.
Ryan, William Thomas,	Honesdale,	Pa.	R. Duane Reed.
Saurman, James S.,	Norristown,	Pa.	Baker & Grady.
Schad, Frank Casper,	Tamaqua,	Pa.	L. J. Steltzer.
Schenkel, William Henry,	Stuttgart,	Germany.	
Schmidt, Oscar Carl,	Philadelphia,	Pa.	G. A. Barwig.
Scott, John Calvin,	Hamburg,	Pa.	A. J. Fink.
Scott, Levi,	Camden,	Del.	Wilkinson & Wilkinson.
Seabold, Henry Adam Fahnestock,	Annville,	Pa.	W. S. Seabold.
Seip, Charles Louis,	Philadelphia,	Pa.	Joseph Crawford.
Settle, Peter Smith,	Philadelphia,	Pa.	T. H. Price, M.D.
Seward, Frank Gates,	Norwich,	N. Y.	Norwich Pharmacal Co.
Shane, Samuel,	Moscow,	Russia.	J. T. Van Burkalow.
Sheffer, William Walter,	Dillsburg,	Pa.	Lawson C. Funk.
Sheppard, Henry Christopher,	Philadelphia,	Pa.	Howard B. French.
Shoffner, John Perry,	S. Bethlehem,	Pa.	Thos. H. Potts, M.D.
Siegle, Herman Christian,	Peoria,	Ill.	A. W. H. Reen.
Smiley, Frances Jane,	Philadelphia,	Pa.	Susan Hayhurst, M.D.
Smith, Wellington Gordon,	Lykens,	Pa.	S. B. Schminky.
Speck, Herbert Arthur,	Bethlehem,	Pa.	Geo. P. Kressler.
Stacks, Abraham Homer,	York,	Pa.	J. C. Perry.
Stein, Joseph Paul,	Philadelphia,	Pa.	Crumbie Bros.
Stinson, William Samuel,	Titusville,	Pa.	Geo. B. Evans.
Stolz, Louis,	Syracuse,	N. Y.	Geo. E. Thorpe.
Stone, Edward Browning,	Camden,	N. J.	Wm. Shafer, M.D.
Stout, Benjamin Franklin,	Quakertown,	Pa.	N. S. Stiltzer.
Sullivan, James Francis,	Hartington,	Neb.	J. G. Beste.
Sunday, Carlton Pierce,	York,	Pa.	R. Wm. Ziegler.

Name.	*Place.*	*State.*	*Preceptor.*
Tanzola, Angelo,	Hammonton,	N. J.	V. Michelotte.
Taylor, Lynwood S.	Spring City,	Pa.	W. Carroll Taylor.
Timmins, Carroll Edwin,	Gettysburg,	Pa.	James Huston.
Tucker, Robert Woodliff,	Bermuda Islands.		J. K. Freeman.
Wenner, Harvey Eugene,	Allentown,	Pa.	A. R. Hesske.
Werts, John Lamont,	Renovo,	Pa.	John F. Neely.
Wetherill, Henry Emerson, M. D.,	Peabody,	Mass.	
Whitall, Edwin Clark,	Woodbury,	N. J.	R. W. Cuthbert.
Wilkinson, Harry,	Philadelphia,	Pa.	R. Powers Wilkinson.
Williams, Joseph James,	Conshohocken,	Pa.	Geo. L. Carman.
Wilson, George Cookman, Jr.,	Reading,	Pa.	J. C. Sanderson.
Witman, Charles Daniel,	Middletown,	Pa.	J. W. Rewalt.
Witmeyer, Samuel David,	Lebanon,	Pa.	Shinn & Baer.
Young, Alexander, Jr.,	Jenkintown,	Pa.	Samuel C. Henry.
Young, Edwin Henry,	S. Bethlehem,	Pa.	Cyrus Jacoby.
Zeller, Harry Lewis,	Tremont,	Pa.	R. T. Blackwood.

SECOND YEAR CLASS LIST.—1897–98.

Name.	*Place.*	*State.*	*Preceptor.*
Allen, Milton Deronda,	Medford,	N. J.	D. W. Fleming.
Andrews, Willard Crandall,	Cortland,	O.	W. C. Andrews.
Anstock, Arthur David,	Mahanoy City,	Pa.	Louis Oliphant.
Arnott, William,	Wilmington,	Del.	Jos. P. Williams.
Aughinbaugh, John Keely,	Greenvillage,	Pa.	Eberly Bros.
Bachman, Herbert Keck,	S. Bethlehem,	Pa.	Luther Gerhard.
Ball, Clifford Arthur,	Hellertown,	Pa.	Ellwood Ball, dec'd.
Balliet, Howard Paul,	Allentown,	Pa.	J. P. Frey.
Bamford, Melvin William,	Reading,	Pa.	R. Powers Wilkinson.
Barnett, Eldredge Ewing,	Cape May City,	N. J.	D. C. Guthrie, M.D.
Bayles, John Wickoff,	Moorestown,	N. J.	A. J. Durand.
Bear, Benj. S. J., V.M.D.,	Mount Joy,	Pa.	Chas. H. Jennings.
Beddow, Llewellyn Jenkins,	Mahanoy City,	Pa.	M. R. Stern.
Blankemeyer, Henry John, Jr.,	Philadelphia,	Pa.	Kennedy & Burke.
Booth, John Henry,	Philadelphia,	Pa.	Long & Co.
Bulger, Walter John,	Conshohocken,	Pa.	J. H. Kerr.
Chalquest, Gustave Emil,	Morristown,	N. J.	E. A. Carrell.
Chamberlain, Lowell Holbrook,	Des Moines,	Iowa.	Irving C. Wood, M.D.
Chamberlin, William Allen,	Indianapolis,	Ind.	Frank Morse.
Clark, John Edward,	Lock Haven,	Pa.	W. C Franciscus & Co.
Cockroft, David Holliday,	Philadelphia,	Pa.	A. F. Hollopeter.
Crain, Charles Edward,	Springfield,	O.	G. & S. Coblentz.
Crawford, Horace Victor,	Laurelton,	Pa.	E. F. Menger.
Culby, Walter Gibson,	Philadelphia,	Pa.	L. A. Breidinger.
Curtis, Henry,	Minneapolis,	Minn.	O. J. Thompson, M D.
Davis, B. K.,	St. Joseph,	Mo.	Muswick & Co.
Davis, Benjamin Winter,	Camden,	N. J.	G. L. Geiger & Co.
Davis, Samuel Bond,	Bridgeton,	N. J.	Reeve & Fithian.
Diehl, George Edward,	Charlestown,	W. Va.	Light & Mason.
Dixon, John Glaspey,	Salem,	N. J.	J. H. Lock, M.D.
Doherty, Harry Aloysius,	Atlantic City,	N. J.	F. E. Post.
Donnelly, Clarence Eugene,	Bridgeton,	N. J.	Frederick Seitz, M.D.
Doubler, George Hougan,	Milton,	Pa.	W. H. Galbreath.
Dunn, Edwin Alfred,	Meadville,	Pa.	P. Henry Utech.
Egel, Frederick William,	Bound Brook,	N. J.	Chas. L. Manning.
Engler, Robert Saylor,	Temple,	Pa.	John B. Raser.
Falkenhainer, Charles,	Guttenberg,	Ia.	James Hervey.
Faulhaber, Gustave Adolph,	Loudenville,	O.	G. A. Appenzeller.

Name.	*Place.*	*State.*	*Preceptor.*
Fishburne, Richard Lewis,	Lock Haven,	Pa.	Andrew Blair & Co.
Fleming, Arthur Bowles,	Chambersburg,	Pa.	J. L. Barnitz.
Gasslein, Richard Joseph,	Philadelphia,	Pa.	James J. Ottinger.
Gillan, Charles McDowell,	Chambersburg,	Pa.	P. B. White.
Grady, William Patrick,	Philadelphia,	Pa.	F. W. E Stedem.
Gruel, John Edward,	Lancaster,	Pa.	John C. Long, dec'd.
Gryning, John Francis,	Philadelphia,	Pa.	Geo. B. Evans.
Hammond, Nathan Brown,	West Chester,	Pa.	Arthur B. Hammond.
Hance, Howard Ivins,	Philadelphia,	Pa.	R. A. Hance.
Hannum, John Lewis,	Media,	Pa.	W. E. Dickeson.
Harrison, Walter B.,	McKeesport,	Pa.	J. C. Smith.
Hartman, Henry Loekle,	Lebanon,	Pa.	Dr. Geo. Ross & Co.
Harvey, Charles John,	Butler,	Pa.	D. H. Wuller.
Heckman, John George,	Meadville,	Pa.	J. G. Lindeman.
Heineberg, Alfred,	Selma,	Ala.	Selma Drug Co.
Hesse, Frederick William,	Savannah,	Ga.	Reid & Co.
Hetrick, Harry Leady,	Altoona,	Pa.	W. M. C. Craine.
Heyl, Charles Ambrose,	Philadelphia,	Pa.	P. M. Kelly, M.D.
Hicks, George Wellington,	Trenton,	N. J.	A. D. Cuscaden.
High, Raymond,	Norristown,	Pa.	W. M. Rickert.
Hill, George Price,	Lansford,	Pa.	Wm. M. Hill.
Hoagland, Robert John;	Peoria,	Ill.	B. G. Clapham.
Hoch, Quintus.	Nazareth,	Pa.	Aquila Hoch.
Holland, Albert J. F.,	Philadelphia,	Pa.	Geo. Holland, M.D.
Holt, Edwin Merrimon,	Goldsboro,	N. C.	C. B. Miller.
Hostetter, Harry Jacob,	Reading,	Pa.	Harry Bitler.
Hottenstein, Peter David,	Kutztown,	Pa.	C. F. Wild.
Hunt, Earl Robert,	Bethlehem,	Pa.	H. G. Kalmbach.
Huzzard, Kurtz,	Norristown,	Pa.	Eugene Fillman.
Jackson, Charles Henry,	Salem,	N. J.	Harry Lippen.
James, Arthur Bernstein,	Kingston,	N. Y.	M. J. Wohlgemuth.
Jenkins, David Evans,	Danville,	Pa.	J. D. Gosh & Co
Kaderly, Eugene John,	New Philad'a,	O.	Opes & Thompson.
Keiser, Frederick,	Milton,	Pa.	C. Carroll Meyer.
Kemp, Lucian Scott,	Dayton,	O.	Justus Schmidt.
Kimberlin, Frederick William,	Norristown,	Pa.	Chas. B. Ashton.
Kincaid, Raymond Keck,	Allentown,	Pa.	Harvey L. Kieper.
Kintzer, Harry Augustus,	Womelsdorf,	Pa.	F. T. Landis.
Klusmeyer, Henry Chester,	Easton,	Pa.	F. L. Mebus.
Koch, Christopher, Jr.,	Philadelphia,	Pa.	C. A. Eckels.
Kraus, Wm. Fred. Constance,	Philadelphia,	Pa.	Otto Kraus.
Krehl, Benjamin,	Buffalo,	N. Y.	T. W. Reuting.
Lacy, Burdett Seldon,	Gloucester City,	N. J.	Wm. E. Lee.
Lauer, Julius Paul,	Millersville,	Pa.	Chas. E. Keeler.
Lefever, John Matthew,	York,	Pa.	S. M. Gable.
Lehman, George Theodore,	Portsmouth,	O.	Frederick Radefeld.
Lock, William,	Philadelphia,	Pa.	H. J. Batdorff.
Love, Thomas B.,	Philadelphia,	Pa.	Bullock & Crenshaw.
McClintock, Theodore Brown,	Jamestown,	N. Y.	Hatch & Briggs.
McClure, Richard Ferris,	Wilmington,	Del.	F. R. Smith, M.D.
McCollin, James Garrett,	Philadelphia,	Pa.	J. M. Wert, M.D.
McCoy, James Edward,	New York,	N. Y.	Howard G. Shinn.
McDonnell, Joseph Francis,	Centralia,	Pa.	G. W. Davis.
McElwain, William Thomas,	Chambersburg,	Pa.	Cressler & Keefer.
McFall, John Allen,	Charlestown,	S. C.	Henry M. Minton.
McGuire, Thomas Edward,	Mahanoy City,	Pa.	Shenandoah Drug Store.
McKeever, William Henry,	Philadelphia,	Pa.	
MacMurray, Annie,	Upland,	Pa.	Wm. H. Farley.
MacPherran, Ivan LeRoy,	Pittsburg,	Pa.	M. M. Dunham.
Mattison, Richard Van S., Jr.,	Ambler,	Pa.	Richard V. Mattison.

Name.	*Place.*	*State.*	*Preceptor.*
Meister, Samuel Emil,	Lancaster,	Pa.	W. D. Chandler.
Mervine, Graydon Duncan,	Milton,	Pa.	J. S. Follmer, M.D.
Mitchel, Edward Waldo,	Philadelphia,	Pa.	E. R. Gatchel.
Mooney, Frank,	Philadelphia,	Pa.	Fred. Schwartz, M.D.
Moury, Joseph Daniel,	Shamokin,	Pa.	
Mutty, William Clement,	S. Brewer,	Me.	F. W. E. Stedem.
Nicklas, David Edward,	Chambersburg,	Pa.	J. L. Barnitz.
Norris, Clarence Augustus,	Manasquan,	N. J.	Andrew Blair.
Orf, George Marion,	Philadelphia,	Pa.	J. J. Finney.
Osterlund, Otto William,	Kinekulle,	Sweden.	Theodore Campbell.
Patrick, William Smith,	Salem,	N. J.	W. H. Dunn.
Peck, William G.,	Nottingham,	England.	O. H. Sterner, M.D.
Pettebone, Thomas J.,	Dorranceton,	Pa.	C. W. Spayd, M.D.
Pflieger, Ellwood Keech,	York,	Pa.	Dale, Hart & Co.
Phillips, John Henry,	Redfield,	N. Y.	W. H. Phillips.
Potts, Samuel Lawrence,	Newtown,	Pa.	Edwin F. Hellyer.
Price, Arthur Chew,	Wilmington,	Del.	Jos. C. Roberts.
Radefeld, Robert,	Philadelphia,	Pa.	Fred. Radefeld.
Raines, Edward Lee,	Memphis,	Tenn.	James S. Robinson.
Ranck, David Walter,	Philadelphia,	Pa.	J. W. Ranck, M.D.
Reice. William,	Bloomsburg,	Pa.	James H. Mercer.
Reigel, M. Calvin,	Linglestown,	Pa.	Geo. B. Evans
Reinhart, Robert Lucian,	Sheperdstown,	W. Va.	S. S. Loughridge.
Rhoads, Robert Elliott,	Reading,	Pa.	I. J. Brandt.
Roessner, Benjamin,	Philadelphia,	Pa.	D. Milligan.
Rogers, Edward Bancroft,	Mt. Holly,	N. J.	E. D. Prickett.
Ross, Dell Noblitt,	Rosemont,	Pa.	Frank W. Prickett.
Rossell, Edward Wood,	Pemberton,	N. J.	Austin R. Haines.
Ryan, William Stephens,	Philadelphia,	Pa.	A. D. Forrest.
Sample, James Turner,	Roaring Springs,	Pa.	C. J. Biddle.
Saylor, Byron Centennial,	Annville,	Pa.	E. Warg.
Schwaemmle, Fred. Philip,	Philadelphia,	Pa.	E. H. Fienhold.
Seitz, John Alphonsus,	Wilmington,	Del.	Z. James Belt.
Seubert, Charles Aloysius,	Lebanon,	Pa.	John F. Loekle.
Shannon, Samuel Coward,	Philadelphia,	Pa.	D. M. Harris.
Shapiro, Henry,	Vitebsk,	Russia.	F. W. E. Stedem.
Sheehan, William Henry,	Dallas City,	Pa.	H. M. Campbell.
Shirey, Orville Ludwig,	Chambersburg,	Pa.	Cressler & Keefer.
Simcox, Howard Leon,	Philadelphia,	Pa.	Geo. W. Bowen, M.D.
Sipes, Clarence Leslie,	McConnellsburg,	Pa.	Chas. Leedom.
Sleifer, Jay Ward,	Bingham,	Pa.	J. A. Wamsley.
Smith, Chas. Ellwood Rupert,	Philadelphia,	Pa.	Shoemaker & Busch.
Smith, George Carroll,	Pottstown,	Pa.	Chas. A. Smith.
Snyder, Herman Hugo,	Philadelphia,	Pa.	Frank C. Davis.
Stahlé. Robert Nevin,	Gettysburg,	Pa.	H. A. Borell.
Stancill, George Walter,	Selma,	N. C.	G. T. Williams.
Stang, Peter,	Philadelphia,	Pa.	Henry Mueller, M.D.
Steel, Chalmers Alexander,	Huntingdon,	Pa.	H. E. Steel.
Stern, Wilson Clinton Ammon,	S. Bethlehem,	Pa.	D. Bruce Richards, M.D.
Stout, Philip Samuel,	Quakertown,	Pa.	Oliver Stout.
Strode, Clark,	Philadelphia,	Pa.	Funk & Groff.
Suhn, Minnie,	Vitebsk,	Russia.	M. Peissakovitch.
Turner, Joseph Constant,	Philadelphia,	Pa.	W. F. Steinmetz.
Van Dyke, James Wilber,	Hightstown,	N. J.	H. G. Rue.
Wagner, Charles,	Philadelphia,	Pa.	Julian Fajans, M.D.
Watson, James Nathaniel,	Elizabethtown,	Pa.	H. C. Blair.
Weakley, William Stair,	York,	Pa.	J. J. Weakley.
Wehn, Clyde Edwards.	Johnstown,	Pa.	Chas. Young.
West, Katherine Powell,	Norristown,	Pa.	Jos. C. Roberts.
Wolf, Charles August,	Philadelphia,	Pa.	L. S. A. Stedem.

Name.	*Place.*	*State.*	*Preceptor.*
Wright, John Franklin,	Canon City,	Col.	Hunter Palmer.
Wyckoff, Elmer Le Roy,	Ithaca,	N. Y.	Fred. H. Blackmer.
Young, Annie Hawkins,	Henderson,	N. C.	Geo. B. Evans.
Zeller, Earl Emanuel,	Mifflinburg,	Pa.	James Klackner.
Ziegler, Chester Winsor,	Gettysburg,	Pa.	Shinn & Baer.

THIRD YEAR CLASS LIST, 1897–98.

Name.	*Place.*	*State.*	*Preceptor.*
Abrams, Frederick Arthur,	Philadelphia,	Pa.	John Wyeth & Bro.
Albert, Henry Clay,	Maysville,	Ky.	
Albright, Charles Henry,	Philadelphia,	Pa.	J. P. Frey.
Baer, Lemuel Miles,	Lancaster,	Pa.	Breidinger & Comber.
Bartholomew, Arthur,	Philadelphia,	Pa.	J. M. Higgins.
Beane, George Ridenour,	Bainbridge,	Pa.	H. C. Blair.
Berberich, Herman,	Stein,	Germany.	James Moffet, Jr.
Berry, Robert Taylor,	Charlestown,	W. Va.	T. H. Franklin.
Beyerle, Charles Wellington,	Bernville,	Pa.	Wm. C. Rowe.
Bishop, David Kerlin,	Patterson,	Pa.	W. G. Nebig.
Black, Robert Morris,	Philadelphia,	Pa.	Geo. B. Maurer.
Bloor, Alfred Wainwright,	Manor,	Texas.	
Booth, Thomas,	Philadelphia,	Pa.	Alexander Wilson.
Brach, Cornelius,	Kerzenheim,	Germany.	W. E. Miller, M.D.
Bradford, Edward Burton,	Newport,	N. J.	A. LaDow.
Bready, William Ramsey, Jr.,	Philadelphia,	Pa.	A. J. Frankeberger.
Brewton, Swain Hoffman,	Cape May City,	N. J.	William Porter.
Brown, Hampton Houseman,	Pleasant Grove,	Pa.	B. L. Brown, M.D.
Buckingham, Harry Sheldon,	Clayton,	N. J.	Howard G. Shinn.
Cassel, Oscar Heebner,	Lafayette Hill,	Pa.	
Cohen, John Thomas,	Chester,	Pa.	R. H. Henderson.
Coleman, John Edward,	Carbondale,	Pa.	B. A. Kelly.
Cooper, Walter Greenlee,	Savannah,	Mo.	J. P. Cooper.
Cox, Linwood,	Norristown,	Pa.	Atwood Yeakle.
Cunningham, Orrick Sim,	Clear Spring,	Md.	Geo. W. Hurd.
Dale, David,	Philadelphia,	Pa.	John Wyeth & Bro.
De Beust, William Hare,	Philadelphia,	Pa.	R. H. De Beust.
Decker, William Robert,	York,	Pa.	S. E. R. Hassinger.
DeHaven, Ida Valeria,	Bayonne,	N. J.	Dennis J. Gerrity.
Dirmitt, Charles Walter,	Philadelphia,	Pa.	Chas. H. Dirmitt.
Downing, William Henry,	Wilmington,	Del.	N. B. Danforth.
Dubell, Alexander,	Mt. Holly,	N. J.	R. C. Barrington.
Estlack, Walter Forrest,	Philadelphia,	Pa.	H. W. Estlack.
Evans, Abner Thomas,	Greenburg,	Pa.	S P. Brown.
Evans, Samuel, Jr.,	Circleville,	O.	Evans & Kimmel.
Farrow, Frederick Reeves,	Leipsic,	Del.	Eberly Bros.
Fisher, Samuel Keim,	Leesport,	Pa.	James C. Brobst, M.D.
Foltz, Edgar Daniel Grant,	Bethlehem,	Pa.	J. H. Spruance.
Friebely, Harry Eugene,	So. Bethlehem,	Pa.	H. A. Burkhart, M.D.
Funk, Robert Rowland,	Hagerstown,	Md.	Blew & Lucas.
Gibb, Andrew,	Lock Haven,	Pa.	W. C. Franciscus.
Gladhill, James White, M.A.,	Jersey Shore,	Pa.	Geo. M. Beringer.
Greer, Mary C.,	Philadelphia,	Pa.	May Reynolds.
Groff, Harry Musselman,	Lancaster,	Pa.	C. W. Warrington.
Grunden, Percival Edward,	Steelton,	Pa.	G. A. Gorgas.
Guth, Herbert Wallace,	Allentown,	Pa.	Peters & Smith.
Haus, Ralph Leonard,	Mifflinburg,	Pa.	W. H. F. Vandegrift.
Heintzelman, Joseph August,	Philadelphia,	Pa.	J. A. Heintzelman.
Heverly, Frederick Chase,	Wilkesbarre,	Pa.	R. D. Williams.

Name.	*Place.*	*State.*	*Preceptor.*
Hoffman, William Anton,	Renovo,	Pa.	E. T. Swain.
Huntington, Joseph,	Philadelphia,	Pa.	J. C. Perry.
Jenkins, Frank Heiston,	Hanover,	Pa.	J. L. Emlet.
Joffe, Jacob Leopold,	Kovno,	Russia.	E. J. Lupin.
Kain, John Kauffman,	York,	Pa.	J. B. Kain, M.D.
Keen, George Carll,	Vineland,	N. J.	J. J. Ottinger.
Keen, George Samuel Jacob,	Wiconisco,	Pa.	C. D. Christman, M.D.
Keenan, John Joseph,	Philadelphia,	Pa.	J. J. Burke, M.D.
Keim, Joseph Paxson,	Bristol,	Pa.	E. Martin.
Kepner, Weldon Stover,	Shippensburg,	Pa.	J. C. Altick & Co.
King, James David,	Easton,	Pa.	Rowland Willard.
Kirby, Frank Brennand,	Philadelphia,	Pa.	Lawson C. Funk.
Krewson, William Egbert, Jr.,	Philadelphia,	Pa.	Wm. E. Krewson.
Kyser, George Herbert,	Richmond,	Ala.	Geo. W. Kyser.
Latchford, Orwan Luther,	Markelsville,	Pa.	D. H. Ross.
Lee, Walter Evan,	Vineland,	N. J.	Bidwell & Co.
Lerch, William Abraham,	Allentown,	Pa.	Peters & Smith.
Levy, Joseph Jacob,	Philadelphia,	Pa.	J. H. B. Amick, M.D.
Lindig, Charles Warren,	Lewisburg,	Pa.	Harry N. Hoffman.
Luebert, August Gustav,	Philadelphia,	Pa.	David A. Over.
MacBride, William Vaughan,	Philadelphia,	Pa.	W. F. Seiler.
McCleary, Harry Walter,	Pinegrove Furnace,	Pa.	J. E. Sipe.
Mathers, Grace,	Philadelphia,	Pa.	Susan Hayhurst, M.D.
Metzler, Walter Scott,	Baltic,	O.	A. S. Metzler, M.D.
Middleton, Claude Ruoff,	Philadelphia,	Pa.	Shinn & Baer.
Miller, William Frederick,	Erie,	Pa.	William Fisher.
Mills, John Leopold,	Cardington,	O.	A. C. Schofield.
Monaghan, Thomas Francis,	Philadelphia,	Pa.	H. D. Stichter, M.D.
Monroe, William Robeson,	Fresno,	Cal.	Geo. H. Monroe.
Morell, Charles Joseph,	Philadelphia,	Pa.	Chas M. Morell.
Morgan, Frank William,	New Orleans,	La.	William Greve.
Mountain, Lloyd Lott,	Confluence,	Pa.	W. S. Mountain, M.D.
Ney, Howard Jacob,	Harrisburg,	Pa.	Chas. F. Kramer.
Parse, Andrew Connet,	Flemington,	N. J.	J. Sherman Cooley.
Perse, James Woodlock,	Plymouth,	Pa.	James V. Perse.
Preston, Gilbert Kent,	Philadelphia,	Pa.	David Preston.
Putt, Milton Thomas,	Lebanon,	Pa.	W. B. Means M.D.
Raker, John Wilson,	Pillow,	Pa.	Chas. H. Tatem, dec'd.
Richardson, James,	Pickering,	Ontario.	George Y. Wood.
Ringer, Louis Johnson,	Hagerstown,	Md.	M. L. Byers & Co.
Rinker, Henry Paul,	Hellertown,	Pa.	C. W. Albright.
Ritz, Charles August,	Ashland,	Pa.	A. Schoenenberger.
Roberts, DeWilton Smith,	Philadelphia,	Pa.	M. A. Hull.
Rose, Frank,	Philadelphia,	Pa.	P. Fitch, M.D.
Ross, Annie Catherine,	Philadelphia,	Pa.	F. W. E. Stedem.
Schlauch, Theodore Storb,	New Holland,	Pa.	C. J. Seltzer.
Seiberling, Joseph Dallas,	Hynemansville,	Pa.	Frank Morse.
Sheitz, Lloyd A.,	York,	Pa.	Harry A. Hay.
Shemp, Russell Nicholas,	Philadelphia,	Pa.	W. E. Supplee & Bro.
Shwab, George Augustus,	Nashville,	Tenn.	
Sieber, Isaac Grafton,	Harrisburg,	Pa.	J. Wilson Hoffa.
Slobodkin, Rose,	Minsk,	Russia.	Susan Hayhurst, M.D.
Smith, Alfred Homer,	Smyrna,	Del.	Wm. F. Dunn.
Smith, Benjamin James,	Trenton,	N. J.	Aquila Hoch.
Snavely, Clarence Osborne,	Lebanon,	Pa.	Wm. G. Shugar.
Snyder, John Paul,	Lancaster,	Pa.	W. T. Hoch.
Steinmetz, William Baer,	Ephrata,	Pa.	G. S. Royer.
Stimus, Howard George,	Moorestown,	N. J.	G. H. Wilkinson.
Stott, Horatio Allen,	Coatesville,	Pa.	W. S. Young.
Strawinski, Jacob Franklin,	York,	Pa.	Dale, Hart & Co.

Name.	*Place.*	*State.*	*Preceptor.*
Swartley, Harry Mahlon,	Philadelphia,	Pa.	F. P. Streeper.
Thompson, Henry Kirk,	Titusville,	Pa.	R. C. Cadmus.
Thompson, Harry Merril,	Selins Grove,	Pa.	T. C. Tomlinson.
Tomlinson, George Walton,	Feasterville,	Pa.	L. H. Lewis.
Troth, Ernest Augustine,	Palmyra,	N. J.	Shoemaker & Busch.
Tyler, William Walston,	Onancock,	Va.	Geo. B. Evans.
Underwood, James Harris,	Woodbury,	N. J.	Campbell & Bro.
Waldner, Herman Theodore,	Ashland,	Pa.	T. H. Strouse.
Walter, William Bell,	Gettysburg,	Pa.	H. C. Blair.
Wilt, George Washington, Jr.,	Flemingsburg,	Ky.	John J. Reynolds.
Winkler, Oscar Charles,	Philadelphia,	Pa.	M. S. Apple.
Winslow, John Hayes,	Vineland,	N. J.	A. C. Taylor.
Zane, William Spence,	Williamstown,	N. J.	G. B. Minton.

SENIOR CLASS LIST.—1897–98.

Name.	*Place.*	*State.*	*Preceptor.*
Brookes, Lulu,	Waelder,	Texas.	J. M. & J. C. Henderson.
Clark, Robert Hall,	Union City,	Ind.	A. LaDow & Co.
Cornell, Horace Hogeland,	Newtown,	Pa.	Robert Glenk.
Entwistle, Albert Henry,	Philadelphia,	Pa.	Chas. H. Roberts.
Failing, William Clark,	Palatine Bridge,	N. Y.	H. C. Blair.
Filer, Burritt Boynton,	Hammonton,	N. J.	J. Frank Meade, M.D.
Fleming, John Halbert,	Collamer,	Pa.	A. W. Smedley, dec'd.
Hebden, William,	Philadelphia,	Pa.	Caleb Scattergood.
Howard, Horace Emory,	So. Hadley,	Mass.	J. J. Ottinger.
Jacoby, William Lawless,	Philadelphia,	Pa.	Bullock & Crenshaw.
Jaeger, Charles Frederick,	Philadelphia,	Pa.	E. E. Bostick.
Jolley, John James,	Pottsville,	Pa.	Frank M. Apple.
Koehler, George,	Philadelphia,	Pa.	E. F. Kaempfer.
Konover, Harold Doble,	Trenton,	N. J.	D. W. Baker.
Langham, John Williams,	Philadelphia,	Pa.	E. Bryan Kyle, M.D.
Lincoln, George Washington,	Philadelphia,	Pa.	Howard G. Shinn.
Malin, George Lawrence,	Atlantic City,	N. J.	W. Wright, M.D., dec'd.
Morse, Thomas,	Montgomery,	Ala.	H. G. Eakin
Pasold, Julius Martin,	Joliet,	Ill.	H. F. Voshage.
Peterson, Walter Vickerstaff,	Philadelphia,	Pa.	C. W. Shull.
Smith, Justin Tone,	Windsor,	Vt.	W. A. Rumsey.
Toelke, Charles,	Philadelphia,	Pa.	Frank E. Morgan.
Weber, Howard Elmer,	Mahanoy City,	Pa.	M. R. Stein.
Weiss, Hervey Beale,	Philadelphia,	Pa.	Bullock & Crenshaw.
Wells, James Ralston, Jr.,	Philadelphia,	Pa.	Bullock & Crenshaw.
Yates, John Julius, Jr.,	Wilmington,	Del.	H. K. Watson.

LIST OF SPECIAL STUDENTS.—1897–98.

Name.	*Place.*	*State.*	*Department.*
Cheney, Millwood C.,	Brooklyn,	N. Y.	Chemistry.
Clement, Adolphe Ernest,	Montreal,	Canada.	Phar. and Chemistry
Corse, Montgomery Beverly,	Lexington,	Va.	Phar. and Botany.
Dirmitt, Charles Walter,	Philadelphia,	Pa.	Chemistry.
Graves, Nelson Zuinglius, Jr.,	Philadelphia,	Pa.	Chemistry.
Hatch, Arthur Joseph,	Overbrook,	Pa.	Chemistry.
Heckeroth, William Conard,	Philadelphia,	Pa.	Chemistry.
Hoft, William Irving,	Philadelphia,	Pa.	Chemistry.
Kinzey, Calvin Otto,	Cumberland,	Md.	Chemistry.

Name.	*Place.*	*State.*	*Department.*
Lowe, Elsie Morgan,	Philadelphia,	Pa.	Botany.
McCracken, John Alwine,	Philadelphia,	Pa.	Chemistry.
Masters, Harry O.,	Thomaston,	Me.	Chemistry.
Matusow, Harry, Ph.G.,	Minsk,	Russia.	Chemistry.
Monahan, Frank,	Titusville,	Pa.	Chemistry.
Post, Edward Meigs, Ph.G.,	S. Seaville,	N. J.	Chemistry.
Preston, Gilbert Kent,	Philadelphia,	Pa.	Chemistry.
Rowe, William C., Ph.G.,	Philadelphia,	Pa.	Chemistry.
Suhr, Charles Louis,	Oil City,	Pa.	Chemistry.
Toplis, William G., Ph.G.,	Philadelphia,	Pa.	Chemistry.
Warner, William James,	Philadelphia,	Pa.	Chemistry.
Whipple, Oscar K.,	Bridgeton,	N. J.	Chemistry.
Wirth, Adam,	New Orleans,	La.	Chemistry.

A GINGER PEELER.